No. 5137.

CENTRAL PROVINCES SECRETARIAT.

Revenue Department.

FROM

R. H. CRADDOCK, ESQ., I. C. S.,

SECOND SECRETARY TO THE CHIEF COMMISSIONER,

Central Provinces,

TO

THE COMMISSIONER OF SETTLEMENTS AND AGRICULTURE,

Central Provinces.

Nagpur, the 2nd December 1897.

SIR,

I am directed to acknowledge the receipt of your letter No. 3400-A—23, dated the 31st August 1897, forwarding a copy of the Annual Report on the Nagpur Experimental Farm for the year ending the 31st March 1897, and to communicate the following remarks and orders of the Chief Commissioner.

2. The circumstances of the season were very adverse and the report shows no results of value from the experiments in manure. But there are two or three matters of practical interest in addition to those noticed in previous years. The experiment showing the superiority of top over set planting in sugarcane cultivation is important. A practice which combines a saving of seed with an increased outturn should prove of assistance to the sugarcane cultivators of the Province, whose produce is at present undersold by *gurh* imported from the North-Western Provinces. The Chief Commissioner believes that in Betul, Chhindwara, Chanda, Bhandara and Sambalpur something might be done towards economies both of seed and fuel. The Betul cultivators have taken readily to the Bihea sugar mill, and the Chief Commissioner does not see why its use should not be extended elsewhere. The area under sugarcane in the Province amounts to 40,000 acres, of which the two Plateau districts contribute 10,000, the Wainganga 8,000 and the Chhattisgarh districts 10,000. The subject should not be lost sight of, materials being collected for an "agricultural bulletin" in the Ledger Series.

3. The other matter of interest is the use of sewage in the neighbourhood of large towns. The Chief Commissioner desires that attempts should be made to extend the Meagher system to some of the fields of agriculturists in the neighbourhood.

I have the honour to be,

Sir,

Your most obedient Servant,

R. H. CRADDOCK,

Second Secretary.

Secretariat Press, Nagpur :—R. D., 2-12-97—440.

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Hemendra Kothari

on 24 February, 2020

No. $\frac{3400}{23}$ A.

FROM

L. S. CAREY, ESQ., I. C. S.,

COMMISSIONER OF SETTLEMENTS AND AGRICULTURE,

Central Provinces,

To

THE THIRD SECRETARY TO THE CHIEF COMMISSIONER,

REVENUE DEPARTMENT,

Central Provinces.

SUBJECT:
Report on the Nagpur Experimental Farm for the year 1896-97.

Dated Nagpur, the 31st August 1897.

SIR,

I have the honour to submit the Annual Report on the Nagpur Experimental Farm for the year ending the 31st March 1897.

2. The rainfall of the year was in excess of the average, but almost the whole amount was concentrated into the short space of $2\frac{1}{2}$ months. There were only 58 rainy days throughout the year as compared with 79 in 1894-95, a rainy day being taken as one on which there was a fall of not less than 10 cents. The character of the season was similar to that of its immediate predecessor, subject to the important qualifications that even less rain fell in September than in 1895-96, and October was absolutely rainless. The following table brings out the deficiency of the rainfall during these two months on which such important issues depend.

	1896-97.	1895-96.	Average of preceding 22 years.
September	2·53	3·51	9·36
October	*Nil.*	1·29	3·03
November	·60	*Nil.*	·96

From the end of August then until late in November, only 2·53 inches were received against a normal average of 12·39 and 4·80 inches registered in 1895-96. The drought of the previous year was then repeated under aggravated conditions. The summer crops for the most part did very poorly, the hot dry winds prevalent in October parched them up and the want of moisture prevented them from coming duly to maturity. Cotton, the lower branches of which had commenced to damp off in the continuous and excessive downpours of August, recovered to a great extent in September, but again drooped under the abnormally dry conditions of October and failed to yield up to average. Til is sown in the black cotton soil of the Farm according to local custom in the last week of August, and requires but little moisture when once it has germinated. It is the only crop to which the season was really suitable and the yield was above normal. The spring crops were put down in dry furrows at a time when the air was singularly devoid of moisture and the temperature was unusually high. Rain that was anxiously expected failed to put in an appearance. Germination was most defective and many of the seedlings rapidly succumbed to the scorching rays of a most powerful sun. The yield of linseed was absolutely nominal. Wheat in the low-lying and more favourably situated fields did better than in

high-lying lands, where only a small proportion of the plants survived. But the stalks were very stunted and ears forming at a very early period of growth, the stage of maturity was reached almost a month before the usual time. Other spring crops suffered similarly, but on the whole gram with its tap-root was less injuriously affected.

3. With conditions so abnormal it will be readily understood that a more unfavourable season for experimental purposes could hardly be imagined. Indeed Indian agriculture would soon cease to exist if such years were often experienced. Apart from defective germination and the mortality of the seedlings, it has from an experimental point of view to be remembered that the crops were far too short a period in the ground to avail themselves properly of the manures which remained unassimilated owing to the utter absence of moisture. Green manuring experiments came to naught, as the buried vegetable matter declined to decompose.

Generally speaking then all experiments with manures, except those that were conducted with irrigation, were robbed of much of their value.

The entire absence of rust, though a matter for congratulation, was in itself an abnormal feature, and the experiments that were designed to investigate its nature, or to ascertain a rust-proof variety of wheat did not add one whit to our knowledge on the subject.

4. The experiment of manuring land for *rabi* crops in August instead of June did not this year declare so markedly in favour of the later date, as was the case with the previous experiments. But the deficiency of the autumn rainfall fully accounts for this feature, as the manure applied in August must have remained to a large extent unassimilated. This experiment being of an important and interesting nature has been duplicated.

5. We shall persist for a few years with experiment series C, which tests the effect on linseed grown continuously of different kinds of manures applied from year to year. I have however no great hopes of its success. All present experience negatives the supposition that land, whatever manure be applied, can year after year yield linseed, and agriculturists maintain that this crop can only be raised on the same land once in five or six years. The object we have in view is to ascertain whether there is any artificial mode of recuperating the soil, so as to render it possible to grow linseed more frequently.

6. The new experiment of ascertaining the effect of phosphatic and other manures on different oil-seeds, appears to me to be of an eminently practical nature and to promise useful results. Til shews a preference for nitrogenous and potassic manures, which is in full accord with such experience as I have acquired in the course of my tours. Two years ago near Lakhnadon, I came across a wonderful crop of til, the success of which was attributed by cultivators to the fact that it was the old *akhar* or standing ground for cattle.

Safflower on the other hand appears to affect phosphatic manures, while in regard to linseed and mustard, no opinion can be hazarded owing to their very poor yield in the year under report.

The site of this experiment will be altered from year to year, so as to remove the objections to growing linseed continuously on the same land.

7. Under the head of "rotation experiments with manures," it is observable that wheat and cotton grown in rotation derive benefit from the recuperation of the soil effected by the burying of papilionaceous weeds, but until the experiment has been conducted during a series of more favourable seasons than has been the case in the past, it will be impossible to judge whether the cost of the green-manuring operation can be recouped and whether the system is therefore a really profitable one.

8. The great superiority of box-dung (which contains urine as well as solid excrements) over stall-dung is well brought out by the experiment in field No. 44. This experiment has been conducted during the past seven years

with consistent success. In the year under report the yield of cotton was quite exceptional, and the larger yields both of wheat and cotton over a series of years indicate that much more might with advantage be done in this part of the country to conserve liquid manure instead of allowing it to go to waste and be carried off into the sea when the village sites are annually swept by the monsoon.

The remarks of Dr. Voelcker in para. 146 of his report of 1893 "on the improvement of Indian agriculture" acquire further force from this experiment, and it would be a step in the right direction were more attention paid to this matter on Court of Wards Estates. The use of litter in the form of waste and coarse grass, shrubs, weeds, leaves and rubbish is apparently the best method of retaining a portion at least of the urine.

9. As to the liming of soils, it is generally supposed that the soils in India contain as a rule a sufficiency of this ingredient. The experiments in field No. 65 point in this direction, but I do not think the system is given quite a fair trial in the absence of the application of a more liberal supply of rich and well-rotted cattle-dung. The attention of the Superintendent will be invited to this matter. The principal object of liming, as I understand it, is to set free by chemical action and thus render available for the crops the valuable nitrates that lie latent in the manures.

10. The new experiment in field No. 40-N deserves passing notice. It was suggested by an article in the *American Agriculturist*, which laid down the general proposition "that it would appear rational to apply no nitrogenous fertilizers to leguminous crops (which science has shewn to be capable of supplying themselves with all they require in this line) but to furnish them with an abundance of both potash and phosphoric acid." The experiment designed by Mr. Joshi with a view to testing this theory is, I think, well-conceived, and, if the outturn of wheat as well as of *tur* is increased by the treatment, will warrant the conclusion that potassic and phosphatic manures not only increase the outturn of the *tur*, but enable it, in virtue of its more vigorous growth, to store more nitrogen for the benefit of the wheat by which it is followed.

11. In regard to our single experiment under the head *tillage*, a mistaken impression that has arisen relative to the conduct of the experiment has to be removed. The third plot is ploughed and scarified in alternate years, and not ploughed every third year and *bakhared* in the intervening two years.

This system appears to have decided advantages over that of ploughing every year or following the native practice of merely scarifying the soil from year to year.

The experiment is now being duplicated on another part of the Farm in accordance with the instructions conveyed in para. 3 of Secretariat letter No. 869, dated 13th February 1897.

12. Our experiments under "varieties of crops" are both varied and instructive, but we have not as yet a sufficient basis on which to formulate definite conclusions in regard to many of the species tried. The experiment with Cairo cotton as a *rabi* crop is still in its infancy, and we have recently expanded the scope of this experiment in arranging for comparative plots to be sown with this fibre in the months of June, July, August, September, October and November. By this exhaustive process we should at length ascertain whether and under what conditions Egyptian cotton can be grown successfully in the Central Provinces.

13. The Garo Hill cotton (an Assam variety) is a short-stapled and rough species, the introduction of which into these Provinces might prove of more harm than good, were it used by ryots to adulterate our local varieties. For the main object we have in view is the improvement of the local staple. I cannot conceive that this coarse variety would be of any use for spinning purposes, but it will be observed that it has already attracted the notice of Mr. J. N. Tata of Bombay (an expert in these matters) who has urged Mr. Joshi not

only to extend his sowings on the Farm, but also to induce cultivators to follow in his footsteps as he is confident of doing a fair business in the commodity. Pending the receipt of further information on the subject, which I have desired the Superintendent to obtain from Mr. Tata, I have requested Mr. Joshi not to supply any Garo Hill seed to outsiders. Meanwhile we are continuing our experiments on the Farm.

14. The Jaunpur maize has again done well. In black cotton soil the best results can apparently be obtained by dint of irrigating the plants in May, whereby they become well established before the advent of the heavy rainfall of July. Otherwise the crop suffers from waterlogging. No such defect is presumably to be apprehended in many parts of the Provinces, maize being grown in well-manured village *baris* that clothe the slopes of the knolls crowned by the village site. The experience obtained on the Farm may be of some use in parts of the Province, where well irrigation is practised in the neighbourhood of the village sites, but our agriculturists are not, I am afraid, sufficiently energetic to take to this style of cultivation even on a small scale.

In view of the abrupt cessation of recent monsoons, it would seem expedient to devote more attention to earlier ripening crops, and as maize comes to maturity in August or early in September, its cultivation would appear to merit extension.

The irrigated crop on the Farm yielded 1,464 lbs. to the acre.

Half an acre would then support a man and his wife for a year allowing them each 1 lb. of meal per diem. The yield of the unirrigated plot was less, but supplemented by *mahua* pickings and harvest earnings, such an outturn from half an acre would support two souls in comfort for a year. These considerations have doubtless to be qualified in view of the difficulty of obtaining suitable manure, &c. For all that the tendency of many of our agriculturists to risk their all in one crop should be combated, and I would look to the Court of Wards for assistance in testing the results obtained on the Farm and exerting an educative effect on the people if the extension of this style of cultivation be found profitable.

15. On the subject of experiments connected with *rust*, it is observable that the new description of wheat obtained by Mr. Joshi from the hybridization of *Houra* and *Mundia Pissi* has yielded a fair amount of grain of a type that looks marketable. The other seeds secured by crossing other varieties do not promise very well.

I have been in correspondence recently with Messrs. Ralli Brothers as to the milling properties and marketable value of *Dhana* or *Jemariya Pissi*, to which allusion is made in last year's report, and which enjoys a reputation in the Saugor and Jubbulpore districts of being rust-proof. They inform me after reference to their Marseilles firm that the flour is good and the value of such is about the same as white *Pissi*. They ask however for further samples as the quantity sent was too small to permit of fair trials.

16. Under the head "experiments with plant diseases" are recorded the results of the trial of 29 cross-bred wheats received through the Government of India from Mr. Farrer of New South Wales, Australia. It is claimed for these varieties that they are rust-resistent, in view of which fact it is strange that rust appeared upon them this year, when there was not a trace of the disease elsewhere on the Farm. The sultriness of the weather occasioned by an overcast sky during part of February, coupled with the frequency of irrigation necessitated by the drought, may help to explain this apparent anomaly.

17. The remarks of Mr. Joshi, *vide* para. 18 of his Report, as to the superiority of the system of planting sugarcane tops instead of sets, derive support from the information embodied in Mr. Goodridge's letter No. 1783A-89 of 29th August 1889, to the Government of India in the Revenue and Agricultural Department, touching cane cultivation in the Barbadoes. I am sending a copy of these papers to the Superintendent and am inviting his special attention to the allegation that white ants damage tops more than sets. His present conclusions may require some qualification on this score.

18. The question of the best mode of disposing of sewage has a distinctly practical interest in the present day. In this view the trial of the system inaugurated by Conductor Meagher of Allahabad should prove useful, and Mr. Joshi has been exhorted to record carefully and systematically the results obtained. The difficulty of working the system in some places is, I learn, connected with the insufficient extent of the areas available for pitting. There should, however, be no such difficulty in Nagpur could the ryots be prevailed upon to lend their fields for the purpose. If once we can demonstrate that the soil is materially enriched and recuperated by the system, all objections should disappear, as no handling of the sewage is involved and the ryot would not, as a rule, lose the use of his field for a single season. If sewage is pitted in a field before the end of March, it can without objection be placed under *kharif* in June. If the sewage be applied in April or May, then presumably a *rabi* crop can be grown, but experience on this head is still lacking. During half June, July, August and September, *i.e.*, during the monsoon, the system would not appear workable and other arrangements would have to be made.

19. The Agricultural School and the Normal Agricultural Class have been conducted on the same lines as in past years. I am now endeavouring to limit the Agricultural School to matriculates, as past experience has shown that students with Middle School qualifications have not sufficient knowledge of English to understand and assimilate lectures on scientific subjects. The scope of the Normal Agricultural Class is being extended. The Inspector-General of Education has appointed a Second Lecturer, and with two courses, or four classes in the year, we hope in future to instruct annually some 100 masters together with 30 or 40 other persons under training in the Normal School, as compared with 66 masters annually instructed in the past.

20. The expenditure of the year is less than that of the five previous years, while the receipts exceed any previous record. I add a few figures which indicate the efficient and economical character of Mr. Joshi's management. The notes appended show that the expenditure of 1891-92 and 1894-95 was swollen by special items.

	Expenditure.			Receipts.
	Salaries.	Contingencies.	Total.	
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1891-92	4,943 11 11	(*a*) 6,521 8 11	11,465 4 10	2,005 2 9
1892-93	4,405 15 9	4,641 5 11	9,047 5 8	2,071 12 9
1893-94	4,040 10 7	4,938 14 7	8,979 9 2	2,373 9 11
1894-95	3,835 8 5	(*b*) 6,999 12 0	10,835 4 5	1,996 14 0
1895-96	3,820 7 3	(*c*) 3,558 3 4	7,378 10 7	2,897 8 9
1896-97	3,790 9 0	2,605 12 2	6,396 5 2	3,129 10 10

	Rs.	a.	p.
(*a*) Includes cost of boundary wire fencing	2,127	7	5
(*b*) Includes cost of building Superintendent's quarters	3,049	7	5
(*c*) Includes cost of constructing a new culvert on Ambajheri road ...	336	15	7

21. Mr. Joshi has continued to display the same good qualities as have characterized his work in the past, and his zeal in the cause of science is unabated. He has willingly afforded me much assistance in dealing with a number of references from the Reporter on Economic Products and has controlled the numerous institutions entrusted to his management to my entire satisfaction.

I have recently had occasion in a separate communication to commend his services to the favourable consideration of the Chief Commissioner.

I have the honour to be,

SIR,

Your most obedient Servant,

L. S. CAREY,

Commissioner of Settlements and Agriculture.

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No. 71 of 1897.

From

The Superintendent,

Government Experimental Farm,

Nagpur,

To

The Commissioner of Settlements and Agriculture,

Central Provinces.

Subject:
Report on the Nagpur Experimental Farm for the year 1896-97.

Dated Nagpur, the 14th July 1897.

Sir,

I have the honour to submit the Thirteenth Annual Report on the working of the Experimental Farm, Nagpur, for the year ending the 31st March 1897.

2. The arrangement of the present Report is the same as that adopted last year, and the order in which the different subjects are treated is as follows :—

I.—History of the Farm.

II.—Character of the Season during the year under report.

III.—Manure Experiments.

IV.—Rotation Experiments without Manures.

V.—Rotation Experiments with Manures.

VI.—Experiments with Mixture of Crops.

VII.—Experiments with Tillage.

VIII.—Variety of Crops.

IX.—Experiments with Plant Diseases.

X.—Method of Cultivation.

XI.—Trial of Implements.

XII.—Distribution of Seeds.

XIII.—Cattle-breeding.

XIV.—Experiments with Fodder and Forest Reserves.

XV.—Sewage Farm.

XVI.—Agricultural Class.

XVII.—Miscellaneous.

I.—HISTORY OF THE FARM.

3. The Nagpur Experimental Farm was established in 1883, in which year the former Model Farm was given up and the present site selected in its stead. The land is close to Nagpur and is of a moderately typical class of the kind which is to be found in the Central Provinces. It consists of a fairly level piece of land of about 90 acres in extent, out of which about 67 acres are under cultivation, the rest being occupied by roads, buildings and waste land. The soil is of the black-cotton type, but somewhat inferior. It varies in depth from 4 to 10 feet, and is situated upon a gneiss rock. The natural drainage is however bad, and *kharif* crops frequently suffer in consequence. The road to Ambajheri, which intersects the farm, acts as a sort of embankment to hold up the water, but new drains have recently been opened, which appear to be answering the purpose for which they were designed.

History.

II.—CHARACTER OF THE SEASON.

Season.

4. The following table compares the rainfall of the year as registered on the Farm with the average of the preceding twenty-two years :—

Rainfall 1896-97.

Month.	Number of rainy days.	Rainfall.	Average of twenty-two years preceding.	Month.	Number of rainy days.	Rainfall.	Average of twenty-two years preceding.
		Inches.	Inches.			Inches.	Inches.
				Total brought forward.	51	51·79	44·50
April ... 1st half ...	...	...	·15	October ... 1st half ...	...	...	1·50
April ... 2nd half ...	1	·12	·23	October ... 2nd half ...	...	...	1·53
May ... 1st half ...	...	...	·24	November 1st half ...	...	...	·77
May ... 2nd half ...	—	·03	·28	November 2nd half ..	2	·60	·19
June ... 1st half ...	4	1·13	3·04	December 1st half ...	...	...	·13
June ... 2nd half ...	7	11·50	5·15	December 2nd half ...	1	·22	·32
July ... 1st half ...	6	8·91	7·41	January ... 1st half ...	...	·06	·39
July ... 2nd half ...	12	10·83	7·14	January ... 2nd half ...	2	·39	·23
August ... 1st half ...	12	12·51	6·40	February 1st half ...	1	·14	·10
August ... 2nd half ...	3	4·23	5·10	February 2nd half ...	...	...	·26
September 1st half ...	3	·90	4·87	March ... 1st half ...	...	...	·25
September 2nd half ...	3	1·63	4·49	March ... 2nd half ...	1	·17	·22
Total carried over ...	51	51·79	44·50	GRAND TOTAL ...	58	53·37	50·39

NOTE.—A rainy day is taken as one on which there was a fall of not less than 10 cents.

The meteorological conditions of the year were on the whole similar to those of 1895-96. The hot weather showers were scanty and therefore did not tend to facilitate the preparation of the land for summer sowings. The monsoon burst almost at the same time as it did in the preceding year, *i. e.*, it was a little late. The sowing of the *kharif* crops commenced on the 20th of June. The rainfall of July and August was exceptionally heavy and continuous and the process of weeding by bullock hoe (Dowra and Dhundia) was materially impeded. For all that the crops such as tur, cotton and juar made vigorous growth. At the end of August the monsoon came to a sudden and abrupt termination. The scanty rainfall of September was however favourable to the cotton crop which dislikes too much moisture at this period of its growth. The bolls grew large and full and the harvest was expected to be as in the previous year a 20-anna crop ; but October was absolutely rainless and the cotton and juar crops, especially those which stood in high-lying fields, suffered to a considerable extent for want of moisture and in consequence of the quite abnormal heat. In the end cotton yielded about 12 to 14 annas and the outturn of juari was about three-fourths of an average crop. The conditions of the season were however peculiarly suitable to til, which grew luxuriantly and yielded a 20-anna crop. The effect of the continued drought in the winter sowings was on the other hand disastrous. The soils caked and hardened and as the seed drill proved in some instances unworkable several of the fields were actually left unsown. In fields in which wheat was sown germination took place only in those parts in which some moisture remained. The young seedlings were further tried by the rapid drying of the soil under the scorching rays of the sun. Early in December the cracks were almost as wide as in ordinary seasons during March and April. The month of November was also practically rainless, and the fall of 0·60 inches in the latter half of that month, *viz.*, on the 22nd and 23rd, came too late to do much good to the wheat plants, some of which had already come into ear. There was moreover a singular absence of the usual dews from which the spring crops annually derive so much benefit. The outturn of wheat amounted in the average to about 5 annas and the stalks were very stunted. The linseed crop was almost a total failure on the Farm. Germination was very uneven and the cloudy weather which followed the hot and dry months of October and November caused material damage by preventing due fructification when the plants were in blossom. Gram which, owing to its tap-root, draws its moisture from a greater depth than wheat, did somewhat better. But even the lower strata of the soil were unable to yield sufficient moisture to support healthy growth and some damage was also caused by insects which were engendered by the cloudy weather of December. The outturn of this crop varied between 8 and 12 annas. As in the previous year there was no rust on the Farm. Another marked effect of the season in the experiments conducted

on the Farm was the failure which attended "green manuring." Owing to the drought the hemp and other crops which were ploughed in failed to decompose properly and their constituents remained in an unassimilable condition.

III.—MANURE EXPERIMENTS.

Manure.

5. The different manures tried on the Farm fall into two classes, *viz.*, *natural* and *chemical*. The *natural* manures are :—

(1) Box-dung.
(2) Stall-dung.
(3) Saltpetre.
(4) Bone-dust.
(5) San-hemp (*Crotolaria juncea*) ploughed in green.
(6) Bawachi (*Psorolia corilifolia*).
(7) Ashes of cattle-dung.
(8) Ambari (*Hibiscus cannabinus*) ploughed in green.

The chemical manures are :—

(1) Ammonium chloride.
(2) Calcium superphosphate.
(3) Potassium sulphate.
(4) Calcium sulphate.

No description of chemical manures is necersary. That of the ordinary manures is given below :—

(1) *Box-dung.*—Box-dung is prepared in the Farm in the following manner. A pit measuring 10′ × 10′ and 2′ × 6′ deep is dug in the cattle-shed and is brick-lined on four sides. A pair of bullocks are tied in the pit, while the other bullocks are stalled in the cattle-shed. The excrements (urine and dung) of the former fall in the pit and the little straw that is left uneaten in the manger is spread over the excrements in the morning when the bullocks are let out either for work or for grazing. It takes generally from five to six months for the pit to be filled up to the top. It is then carted away and deposited in an ordinary pit dug in the ground for storing manure. These pits are covered over with straw to check evaporation, and are watered occasionally in the hot weather between March and June. The manure is not used until the lapse of one year from the date of deposit. As this manure contains about one-half litter, a larger proportion is applied to an acre of land, *viz.*, 240 maunds compared with 160 maunds of stall-dung manure, which contains no litter.

(2) *Stall-dung.*—The term stall-dung is applied to dung collected from the cattle-shed from day to day and stored in an ordinary pit. This manure is also covered over with straw and watered at intervals in the hot weather. It contains no urine, but only the solid excrements of the bullocks without straw.

(3) *Saltpetre.*—The saltpetre that is used on the Farm is crude saltpetre, obtained from Cawnpore through the Director of Land Records and Agriculture, North-Western Provinces and Oudh. It is of two descriptions, black crude and white, which is a purer variety. The amount of saltpetre applied in the Farm is 240 lbs. to the acre, and it is, as a rule, drilled in with the seed. A sample, similar to that used in the year under report, was analysed by Dr. Leather in the previous year—the results of this analysis are given in last year's report.

(4) *Bone-dust.*—This manure is prepared in the following manner: bones of animals are pounded in a mill, such as is usually used for grinding lime (chunam). They are then passed through a sieve, and the fine powder resulting is applied at the rate of 360 lbs. to the acre, the method of application being the same as in the case of saltpetre.

(5) *San-hemp* (crotolaria juncea) *ploughed in green.*—The seed of the hemp is sown broadcast at the beginning of the rains at the rate of 100 lbs. per acre. On the 15th of August as the plants approach maturity, they are uprooted by hand and are buried in the furrows made by the Swedish plough. The plant san-hemp is one of the order *Leguminosæ*, sub-division *papilionacæ*, which have the property of storing nitrogen from the atmosphere at their roots by the aid of nodules.

(6) *Psorolia corilifolia.*—This weed grows in abundance on the waste lands of the Farm. Being a papilionaceous weed, it possesses the property of storing nitrogen like san-hemp, hence it has been selected for the purpose of green manuring. These plants are raised and ploughed in just in the same fashion as described above for hemp.

(7) *Ashes of Cattle-dung.*—Cattle-dung is collected and made into cakes which, when dry, are burnt and reduced to ashes; 3,080 lbs. are applied per acre.

(8) *Ambari* (Hibiscus cannabinus) *ploughed in green.*—The seed of this plant is broadcasted at the beginning of the rains at the rate of 50 lbs. per acre. On the 15th of August

the plants are uprooted by hand and buried in furrows made by the Swedish plough. The plant Ambari belongs to the order *malvaceæ*, which do not possess the property of storing nitrogen from the atmosphere at their roots by the aid of nodules like the subdivision *papilionacæ*.

Experiments with different manures.

6. Eleven experiments were instituted to test the comparative value of different manures or different methods of manuring. Perhaps the most important are those which are conducted on the two series of plots called A and B, in which wheat is annually manured with different materials, the only difference in the treatment being that the A series * is irrigated whilst the B series does not receive artificial irrigation. Series A was started thirteen years ago, series B seven years ago.

In fields Nos. 18 and 32 the effect of manuring wheat with a green crop ploughed into the land in August is compared with the outturn of land manured with cattle-dung. The effect also on the wheat crop of saltpetre is tested in fields Nos. 68 and 23, the former of which is irrigated. In fields Nos. 15 and 22 wheat is manured with cattle-dung, which is put on the land at different periods, two plots being manured in June and the other in August. The site of this experiment has been altered, and it has been duplicated.

A series of plots are manured on the system devised by Mr. G. Ville, but for the last two years linseed cropping has been substituted for wheat.

In field No. 55 the effcet of manuring wheat with a green crop (having the property of storing nitrogen) ploughed into the land in August is compared with the outturn of land manured with a crop ploughed in green, but which has not the property of storing nitrogen from the atmosphere.

In a series of plots lettered C, an experiment to test the effect of ordinary manures on a linseed crop is tried.

Lastly in fields Nos. 9 and 59 an experiment to test the effect of phosphatic manures on different oilseeds, such as safflower (*Carthamus tinctorius*), til (*Sesamum*), linseed and mustard is tried. This is a new experiment suggested by Dr. Leather—*vide* para. 3 to Annexure E of last year's Report.

7. The results obtained in the case of each of these experiments during the year under report are tabulated in the following statements together with those of previous years, and such remarks as are deemed necessary are added in each case.

SERIES A. SUBJECT.—*Effect on wheat grown continuously of different kinds of manures applied year after year with irrigation.*

Plot	I.	—Area 0·10 acre.	Manured with	saltpetre, 240 lbs. per acre.
„	II.	„ 0·10 „	„	bone-dust, 360 lbs. per acre.
„	III.	„ 0·10 „	„	saltpetre, 240 lbs. and bone-dust, 360 lbs. per acre.
„	IV.	„ 0·10 „	„	dung, 160 maunds per acre.
„	V.	„ 0·10 „	„	dung, 160 maunds per acre and bone-dust, 360 lbs. per acre.
„	VI.	„ 0·10 „	„	ashes of 160 maunds dung per acre.
„	VII.	„ 0·10 „	Unmanured.	
„	VIII.	„ 0·10 „	Green manured with	san-hemp.

Commenced in 1890-91. Irrigated once from the 20th to the 23rd November 1896. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Cost of manure per acre.	COST OF IRRIGATION.		Gain in value on plot No. 7.
	AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					Labour.	Assumed water-rate per acre of watering.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.					
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	931	1,789	1,188	1,537	796	804	44 11 8	14 2 8	16 11 0	0 15 0	2 0 0	26 14 1
II	626	954	765	835	391	469	22 3 11	13 2 10	3 6 0	1 4 0	2 0 0	4 6 4
III	1,012	1,924	1,145	2,005	806	854	45 7 0	13 10 4	20 1 0	0 10 0	2 0 0	27 9 5
IV	717	1,217	1,050	1,320	734	806	41 7 10	14 12 8	12 5 6	0 11 8	2 0 0	23 10 3
V	739	1,343	1,294	1,706	778	792	43 11 10	13 8 8	15 12 4	0 15 0	2 0 0	25 14 3
VI	584	915	754	1,074	560	600	31 9 6	12 14 8	11 13 2	0 10 0	2 0 0	13 11 11
VII	486	820	517	702	316	344	17 13 7	13 7 0	...	0 10 0	2 0 0	...
VIII	564	1,090	580	730	424	516	24 2 5	13 13 8	6 14 0	0 10 0	2 0 0	6 4 10

NOTE.—The figures of average outturn from 1890-91 to 1896 are transferred from the B series.

* The treatment of the A and B series has this year been reversed in accordance with Dr. Leather's suggestion, *vide* para. 2 of Annexure E to last year's Report. Under the present arrangement the artificial irrigation cannot in any circumstances reach the unirrigated plots as was possible under the old disposition.

Wheat was sown on the 7th October and was reaped on the 11th February. The practice hitherto was to irrigate B series of plots which are situated at a distance from the cistern ; but in the year under report it was resolved to irrigate A series of plots which are close to it and to leave B series unirrigated. The manures applied to the plots in this series produced some effect owing to irrigation, but in consequence of the exceptional drought and high temperature of the season, the plants were weak and sickly and were unable to avail themselves to the full of the manure supplied to them. The outturn of all the plots fell short of the average except those which were manured with dung and dung mixed with bone-dust.

SERIES B. SUBJECT.—*Effect on wheat grown continuously of different kinds of manures applied year after year without irrigation.*

Plot I.—Area 0·10 acre. Manured with saltpetre, 240 lbs. per acre.
„ II. „ 0·10 „ „ bone-dust, 360 lbs. per acre.
„ III. „ 0·10 „ „ saltpetre 240 lbs. and bone-dust, 360 lbs. per acre.
„ IV. „ 0·10 „ „ dung, 160 maunds per acre.
„ V. „ 0·10 „ „ dung, 160 maunds per acre and bone-dust, 360 lbs. per acre.
„ VI. „ 0·10 „ „ ashes of 160 maunds dung per acre.
„ VII. „ 0·10 „ Unmanured.
„ VIII. „ 0·10 „ Green manured with san-hemp.

Commenced in 1884-85. Unirrigated. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.									Cost of cultivation per acre.	Cost of manure per acre.	Gain in value on plot No. 7.
	Average of five years, 1885—89.		Average of preceding five years, 1890—94.		1895-96.		1896-97.					
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.			
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I ...	1,133	1,711	751	1,468	836	1,006	456	554	25 15 5	11 1 6	16 11 0	15 8 1
II ...	891	1,388	534	882	486	654	241	359	13 15 5	11 6 6	3 6 0	3 8 1
III ...	1,094	1,751	865	1,538	621	709	472	647	27 2 5	11 12 4	20 1 0	16 11 1
IV ...	913	1,520	627	1,393	532	678	286	464	16 11 5	10 14 2	12 6 4	6 4 1
V ...	953	1,415	666	1,224	632	729	374	576	21 11 11	12 1 4	12 5 6	11 4 7
VI ...	949	1,598	576	1,125	621	691	231	339	13 5 10	10 12 6	11 13 2	2 14 6
VII ...	799	1,297	418	796	209	316	167	462	10 7 4	10 10 0	...	...
VIII ...	705	1,137	584	1,115	236	311	65	255	4 5 6	8 6 2	8 9 6	—6 1 10

NOTE.—The figures of average outturn from 1885—1896 are transferred from the A series.

Wheat was sown in these plots on the same day as in the plots of the A series. The crop was reaped on the 30th of January. Owing to abnormal drought it came into ear very rapidly on a stunted stalk and ripened prematurely. For the same reason the manures remained to a large extent unassimilated, but the rainfall of November must have dissolved some of the saltpetre and in a less degree particles of the dung. In this way I think the excess of the outturn of the plots manured with dung and saltpetre over the unmanured and other plots may be explained. The short time that the crop was in the ground this season has also to be considered. The outturn of plot No. VIII of this series which was manured with san-hemp ploughed into it, is the lowest of the plots of that series as the hemp remained in the ground altogether unassimilated. This was noticed when the field was sown with the seed drill the tines of which brought up the undecomposed stems of hemp, that were lying buried in the ground. Apart from this the turning up of the soil with the Swedish plough and the loosening of its particles doubtless led to rapid evaporation of the surface moisture. Thus it may be accepted that green manuring in a season such as the one under report must do positive harm.

FIELD NO. 18. SUBJECT.—*Relative effect of green-manuring, box-dung and stall-dung on wheat grown continuously.*

Plot I.—Area 0·25 acre. Green-manured with Bawachi (*Psorolia corilifolia*) every year.

„ II. „ 0·25 „ Unmanured.

„ III. „ 0·25 „ Manured with box-dung @ 240 maunds per acre.

„ IV. „ 0·25 „ Manured with stall-dung @ 160 maunds per acre.

Commenced in 1890-91. Unirrigated. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Cost of manure per acre.	Gain in value on plot No. II.
	AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.			
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	594	878	276	433	32	75	1 15 4	8 1 8	6 6 8	—1 12 8
II	473	727	462	640	63	121	3 12 0	8 8 0	...	...
III	657	1,179	755	1,036	185	375	11 1 5	9 3 4	12 2 8	+7 5 5
IV	624	878	798	1,161	202	441	12 3 6	9 1 8	11 15 0	+8 7 6

The seed of *Psorolia corilifolia*, a papilionaceous weed, was sown in plot No. I in the month of May. It germinated well. Plots Nos. III and IV were manured with box-dung and stall-dung in the same month. Wheat was sown on the 4th of October in all plots and reaped on the 27th of January. Owing to the excessive dryness of the season and the high-lying position of the fields the outturns were very poor. It is not surprising that the green-manured plot (No. I) yielded a comparatively small outturn as the Bawachi failed to decompose owing to want of moisture in the soil. The experience of the previous year in this respect was accentuated. Plot No. III manured with box-dung which, owing to the admixture of straw, is a bulky manure and keeps the soil loose, has not given such good results as plot No. IV, which is manured with stall-dung. The latter manure does not tend to make the soil so porous as the former, which is an advantage in years of deficient rainfall.

FIELD NO. 32. SUBJECT.—*Effecton wheat of green-manuring with cut papilionaceous weeds, Bawachi (Psorolia corilifolia) collected from waste land.*

Plot I.—Area 0·16 acre. Annually green-manured with Bawachi.

„ II. „ 0·16 „ Unmanured.

Commenced in 1891-92. Unirrigated. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.					Cost of cultivation per acre.	Cost of green-manuring.	Gain in value on plot No. II.
	AVERAGE OF PRECEDING FIVE YEARS, 1891-92 TO 1895-96.		1896-97.					
	Grain.	Straw.	Grain.	Straw.	Value.			
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	759	1,345	329	452	18 14 10	10 9 3	2 9 2	—0 8 3
II	551	1,000	333	535	19 7 1	9 13 3	...	...

NOTE.—In the year under report Bawachi was sown in the field and not collected from waste land and ploughed in, hence the decrease in the cost of manures.

In this field the seed of *Psorolia corilifolia* was not sown in the plots as in the case of plot No. I of field No. 18; but was uprooted and carted from waste places about the Farm, and buried in the land on the 20th of August. The position of the field being low-lying, it retained moisture to some extent and the decomposition of the manure was more effective than in the previous experiment where the weed remained practically unassimilated. Hitherto the manured plot has year by year yielded in substantial excess of the unmanured. This year the outturn being about the same, no advantage accrued from green-manuring. But the conditions of the year were quite abnormal.

FIELD NO. 23. SUBJECT.—*Effect on wheat of manuring with saltpetre at different rates per acre without irrigation.*

Plot I.—Area 0·30 acre. Unmanured.
„ II. „ 0·30 „ Saltpetre, 240 lbs. per acre.
„ III. „ 0·30 „ Saltpetre, 80 lbs. per acre.
Commenced in 1896-97. Unirrigated. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.			Cost of cultivation per acre.	Cost of manure per acre.	Gain in value on plot No. I.
	Grain.	Straw.	Value.			
	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	208	375	12 4 9	9 3 2	...	...
II	187	343	11 1 2	8 15 0	16 11 0	—1 3 7
III	232	447	13 13 1	8 8 4	5 9 0	+1 8 4

FIELD NO. 68. SUBJECT.—*Effect on wheat of manuring with saltpetre at different rates per acre with irrigation.*

Plot I.—Area 0·10 acre. Unmanured.
„ II. „ 0·10 „ Saltpetre, 240 lbs. per acre.
„ III. „ 0·10 „ Saltpetre, 80 lbs. per acre.
Commenced in 1890-91. Once irrigated on 11th and 12th November 1896. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Cost of manure per acre.	COST OF IRRIGATION PER ACRE.		Gain in value on plot No. I.
	AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					Labour.	Assumed water-rate per acre of watering.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.					
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	558	1,133	1,264	1,666	1,022	1,217	58 1 9	13 12 0	...	0 12 6	2 0 0	...
II	937	1,848	1,269	1,347	785	805	44 2 7	13 2 10	16 11 0	1 14 0	2 0 0	—13 15 2
III	540	919	932	1,127	420	520	23 15 3	8 12 10	5 9 0	1 4 0	2 0 0	—34 2 6

NOTE.—Up to 1893-94 third plot was top-dressed with 80 lbs. of saltpetre, but since 1894-95 80 lbs. of saltpetre was drilled in with the seed.

On his visit to the Farm in March 1896, Dr. Leather observed that the application of saltpetre 80 lbs. to the acre gave no advantage over the unmanured plot. He suggested the duplication of the experiment, so as to make sure that the unmanured plot of field No. 68 did not enjoy some special advantages which were unascertainable. At the same time he urged that the saltpetre should, following the practice in England, be applied at an earlier stage in the growth of the plant. A reference to para. 4 of Annexure E to last year's Report is invited. No irrigable plot was available for the conduct of the duplicated experiment. It was accordingly decided to conduct the two experiments on the same lines in the two fields, with the single exception that field No. 68 should continue to be irrigated as in the past, while field No. 23 dispensed with artificial watering. Our previous practice prior to 1894-95 was to top-dress the 80 lbs. of saltpetre in plot No. III when the wheat was 7 or 8 inches high. Now we drill in 80 lbs. of saltpetre with the seed in plot No. III, while the practice in regard to plot No. II has remained unaltered except that the top-dressing takes place when the wheat is 4 instead of 8 inches high. It is intelligible that the saltpetre should have had no effect on the unirrigated plot in a year of such drought. On the other hand it is impossible to account for the fact that the unmanured plot in the irrigated series did so much better than the manured portions. The changes in procedure effected under Dr. Leather's advice have brought us no nearer to a conclusion, and the conviction is being forced upon us that the site of the experiment should be altered.

FIELDS NOS. 15 AND 22. SUBJECT.—*The effect of manuring wheat at different times of the year*, i.e., *June and August.*

FIELD NO. 15.

Plot I.—Area 0·23 acre. Manured with 160 maunds dung in June.
„ II. „ 0·23 „ Manured with 160 maunds dung in August.

FIELD NO. 22.

Plot I.—Area 0·28 acre. Manured with 160 maunds dung in August.
„ II. „ 0·28 „ Manured with 160 maunds dung in June.
„ III. „ 0·28 „ Manured with 160 maunds dung in August.

Crop, wheat 'haura)—Nagpur. Unirrigated.

No. of field.	No. of plot	OUTTURN PER ACRE.			Cost of cultivation per acre.	Cost of manure per acre.
		Grain.	Straw.	Value.		
		lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
15	I	131	351	8 2 7	11 2 11	11 5 6
...	II	146	350	8 15 2	9 12 10	11 14 6
22	I	160	376	9 12 5	9 0 0	11 14 2
...	II	161	314	9 9 8	8 10 8	11 15 8
...	III	146	407	9 2 6	8 6 9	11 14 2

The usual practice amog the cultivators in these Provinces is to manure their fields in June. Having observed that the heavy rainfall of the monsoon washes away the soluble particles of the manure into the drains, I devised an experiment of manuring one set of plots as usual in June, while the manuring of the corresponding plots was deferred till August. The manure was spread over the plots on the 7th June and the 22nd of August. Between the latter date and the end of September the rainfall amounted to only 6·68 inches. Plot No. II of field No. 15, which was manured in August, gave an increase in produce of 15 lbs. over plot No. I, which was manured in June. In field No. 22 the results are somewhat conflicting in consequence probably of the excessive drought of the season.

This experiment has been carried out for the past three years on different sites. During the first two years we obtained an average outturn of 434 lbs in the case of those plots manured in June against 519 lbs. from the areas manured in August. The experiments of the present year do not throw much light one way or the other, on the matter under investigation.

VILLE SERIES. SUBJECT.—*Practical method of soil analysis by using chemical manures, as devised by Mr. George Ville.*

Plot I.—Area 0·05 acre. Manured with Ammonia chloride, 140 lbs. per acre.
„ Calcic superphosphate, 180 lbs. per acre.
„ Potassic sulphate, 90 lbs. per acre.
„ Calcic sulphate, 100 lbs. per acre.
„ II. „ 0·05 „ „ As above less calcic superphosphate.
„ III. „ 0·05 „ „ As in plot No. I less Ammonic chloride.
„ IV. „ 0·05 „ „ No manure.
„ V. „ 0·05 „ „ As in plot No. I less potassic sulphate.
„ VI. „ 0·05 „ „ As in plot No. I less calcic sulphate.

Commenced in 1895-96. Unirrigated. Crop, linseed (chaval-katha).

No. of plot.	OUTTURN PER ACRE.					Gain in value on plot No. IV.
	1895-96.		1896-97.			
	Seed.	Stalks.	Seed.	Stalks.	Value.	
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I	160	360	2	37	0 3 5	—0 9 5
II	180	390	4	36	0 4 11	—0 7 11
III	197	372	7	72	0 9 1	—0 3 9
IV	155	355	12	67	0 12 10	...
V	172	336	5	55	0 6 8	—0 6 2
VI	160	303	2	37	0 3 5	—0 9 5

This is the second year in which, under Dr. Leather's advice, linseed was substituted for wheat in this experiment.

The season was a very unfavourable one. Germination was most defective, the scorching rays of the October and November sun withered the seedlings and the outturn was absolutely nominal.

FIELD No. 55. SUBJECT.—*Effect of nitrogenous and non-nitrogenous crops buried green n soils on wheat.*

Plot I.—Area 0·27 acre. San-hemp ploughed in green.
„ II. „ 0·27 „ Amradi ploughed in green.
Commenced in 1895-96. Unirrigated. Crop, wheat (haura)—Nagpur.

No of plot.	Outturn per acre.					Cost of cultivation per acre.	Cost of manure per acre.
	1895-96.		1896-97.				
	Grain.	Straw.	Grain.	Straw.	Value.		
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	302	512	34	99	2 2 5	7 11 2	9 3 10
II	299	421	12	69	0 14 1	7 7 9	4 2 1

Last year this experiment was conducted in two fields Nos. 40 and 55. This year the *ambari* failed altogether in field No. 40. The wheat crop was very sparse in field No. 55 and the results hardly deserve tabulation. The experiment will be continued.

SERIES C. SUBJECT.—*Effect on linseed grown continuously of different kinds of manures applied year after year.*

Plot I.—Area 0·10 acre. Manured with Saltpetre, 240 lbs. per acre.
„ II. „ 0·10 „ „ bone-dust, 360 lbs. per acre.
„ III. „ 0·10 „ „ Tarota (Cassia tora) to be ploughed in green.
„ IV. „ 0·10 „ „ dung, 160 maunds per acre.
„ V. „ 0·10 „ „ Bawachi (Psorolia corilifolia) to be ploughed in green.
„ VI. „ 0·10 „ „ ashes of 160 maunds dung.
„ VII. „ 0·10 „ Unmanured.
„ VIII. „ 0·10 „ Green-manured with san-hemp.
Commenced in 1895-96. Crop, linseed (haura).

No. of plot.	Outturn per acre.					Cost of cultivation per acre.	Cost of manure per acre.	Gain in value on plot No. VII.
	1895-96.		1896-97.					
	Seeds.	Stalks.	Seed.	Stalks.	Value.			
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	411	589	130	305	7 11 5	6 13 2	16 11 0	−2 0 3
II	521	739	164	496	10 1 3	7 3 10	3 6 0	+0 5 7
III	571	819	111	379	6 15 3	6 6 6	23 8 8	−2 12 5
IV	500	780	191	439	11 4 10	7 8 0	12 5 6	+1 9 2
V	492	734	127	352	7 11 3	4 7 8	6 7 4	−2 0 5
VI	531	875	147	412	8 14 10	6 14 10	11 5 8	−0 12 10
VII	445	682	157	502	9 11 8	7 0 6	...	...
VIII	365	575	44	266	3 1 11	3 7 10	8 15 4	−6 9 9

This series was started in accordance with Dr. Leather's suggestion, which will be found recorded in his note, a copy of which is attached to the Farm Report for 1893-94. The only difference between this and the Ville series is that we are here using natural instead of chemical manures. The field in which the experiment is conducted is a good one. It was cropped with linseed last year.

The outturns in all plots were decidedly poor. The season was most unfavourable to linseed. It remains to be seen whether the poor results are a mere incident of the season or whether even with the help of manure it is possible to grow linseed for a succession of years in the same land. The past experience obtained on the Nagpur Experimental Farm is to the contrary.

FIELD NOS. 9 AND 59. SUBJECT.—*Effect of phosphatic manures on different oil-seeds suggested by Dr. Leather.*

FIELD No. 9.		FIELD No. 59.	
Plot I.—Area 0·27 acre.	Unmanured.	Plot I.—Area 0·31 acre.	Unmanured.
„ II. „ 0·27 „	Saltpetre, 281·9 lbs. per acre.	„ II. „ 0·31 „	Saltpetre, 281·9 lbs. per acre.
„ III. „ 0·27 „	Burnt bones, 277 lbs. per acre.	„ III. „ 0·31 „	Burnt bones, 277 lbs. per acre.
„ IV. „ 0·27 „	Raw bones, 393 lbs. per acre.	„ IV. „ 0·31 „	Raw bones, 393 lbs. per acre.
„ V. „ 0·27 „	Raw bones, 393 lbs. and saltpetre, 281·9 lbs. per acre.	„ V. „ 0·31 „	Raw bones, 393 lbs. per acre and saltpetre, 281·9 lbs. per acre.

No. of field.	Sub-plot.	Area.	Kind of crop.	OUTTURN PER ACRE.		Remarks.	No. of field.	Sub-plot.	Area.	Kind of crop.	OUTTURN PER ACRE.		Remarks.
				Seed.	Stalks.						Seed.	Stalks.	
		Acres.		lbs.	lbs.				Acres.		lbs.	lbs.	
9	IE	·14	Til ...	243	714		59	IE	·15	Linseed ...	5	48	
	IIE	·14	„ ...	362	936			IIE	·15	„ ...	1	12	
	IIIE	·14	„ ...	221	671			IIIE	·15	„ ...	5	49	
	IVE	·14	„ ...	218	764			IVE	·15	„ ...	6	47	
	VE	·14	„ ...	154	664			VE	·15	„ ...	5	48	
	IW	·13	Kardi ...	384	778			IW	·16	Mustard ...	74	148	
	IIW	·13	„ ...	359	1,149			IIW	·16	„ ...	61	111	
	IIIW	·13	„ ...	441	697			IIIW	·16	„ ...	78	131	
	IVW	·13	„ ...	458	750			IVW	·16	„ ...	144	281	
	VW	·13	„ ...	321	556			VW	·16	„ ...	65	116	

Past experiments on the Farm have tended to indicate that bones may prove of value to linseed and other oilseeds, though phosphates have never as yet been shown to be of much use for cereals. In accordance then with the suggestion embodied in para. 3 of Dr. Leather's Note, dated 10th March 1896, on the inspection of the Farm appended to the Farm Report for 1895-96 (Annexure E), we are now trying the effect of phosphatic manures on the four oil-seeds.

(*a*) Til.

(*b*) Kardi (safflower) *Carthamus tinctorius.*

(*c*) Linseed.

(*d*) Mustard.

Field No. 9 was divided into ten parts, five of which were sown with til, and five with safflower. The seed was sown on the 4th of September. The manures were drilled in with the seed. Til germinated well, but the plots on which safflower was grown had to be re-sown on the 28th September as the previous sowing germinated unevenly.

Field No. 59 was also divided into ten plots, five of which were sown with linseed and five with mustard. The seed was sown on 1st October. This field has been impoverished by linseed, and it is resolved to try next year linseed and mustard in field No. 9 and til and safflower in field No. 59. The til and kardi crops did fairly well, but linseed and mustard yieldedvery poorly

This being the first year of the experiment, it is too early to formulate conclusions ; but it is observable that til did regularly well in the field manured with saltpetre, a nitrogenous manure, while the phosphatic manures appear to have benefited the safflower in plots III and IV.

IV.—ROTATION EXPERIMENTS WITHOUT MANURES.

Rotation.

8. These experiments are conducted in three different fields. Their object is to test the practices observed by the cultivators of these Provinces and to see whether there is any practical possibility of improving on them. In field No. 29 wheat is followed by gram, juari, &c., or a fallow. In field No. 57, linseed is followed by cotton and other crops. In field No. 61 cotton-tur is followed by wheat and gram. The most important of these experiments are those conducted in fields Nos. 29 and 57. Experiments in fields Nos. 29 and 57 were started six years ago; while the experiment in field No. 61 began in 1893-94. The results which have been obtained in the case of each of these plots are tabulated below and are compared with those of previous years.

FIELD NO. 29. SUBJECT.—*Effect of rotation with wheat.*

Plot I.—Area 0·13 acre. Wheat every year.

„ II „ 0·13 „ Wheat and fallow alternately.

„ III „ 0·13 „ Wheat and gram alternately.

„ IV „ 0·13 „ Wheat and juar and tur (mixed) alternately.

„ V „ 0·13 „ Wheat and kodon alternately.

Commenced in 1890-91. Unmanured and unirrigated. For cropping, see column 2 below.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Total outlay in cultivation per acre since commencement of experiment (7 years).	Total value of produce per acre since commencement of experiment (7 years).	Total profit per acre since commencement of experiment (7 years).
		Average of preceding five years, 1890-91 to 1894-95.		1895-96.		1896-97.						
		Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.				
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Wheat...	578	960	855	1,031	331	523	19 4 8	8 4 8	59 7 4	163 4 1	103 12 9
II	Wheat...	638	1,338	...	...	382	626	22 15 3	8 13 0	40 12 2	98 10 5	57 14 3
	and Fallow...	...	...	...	...	...	...	...	...			
III	Wheat...	568	1,225	...	...	441	774	25 15 9	9 13 8	59 0 4	142 5 2	83 4 10
	and Gram ...	444	840	508	840	...	...	...	...			
IV	Wheat...	654	1,320	...	...	283	533	16 13 0	8 13 0	64 6 4	197 1 4	132 11 0
	and Juar ...	164	2,228	579	2,663	...	...	...	...			
	and Tur ...	259	741	566	853	...	...	...	...			
V	Wheat...	726	1,402	...	...	205	426	12 5 1	8 2 9	58 3 4	109 4 11	51 1 7
	and Kodon...	399	638	549	628	...	...	...	...			

During the year under report wheat was sown in all the plots. The sowings commenced on the 6th of October, and the crop was reaped on the 29th of January. Plot No. III, in which wheat followed gram, gave the largest yield. Plot No. II which was cropped with wheat after lying fallow for a year stands second. Plot No. IV in which the rotation is with juar and tur stands fourth, while plot No. V, rotated with kodon, stands last. This last rotation is not a profitable one as kodon does not fetch a good price in the Nagpur market. A few more years are required before it can be decided whether there is any rotation equal to that of juari and tur grown as a mixed crop after wheat. This is the common practice of the Nagpur country.

FIELD No. 57. SUBJECT.—*Rotations with linseed.*

Plot I.—Area 0·28 acre. Linseed every year.
„ II „ 0·28 „ Linseed and gram alternately.
„ III „ 0·28 „ Linseed and cotton alternately.
„ IV „ 0·28 „ Linseed and tur alternately.

Commenced in 1890-91. Unmanured and unirrigated. The crop in the year was linseed.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Total outlay in cultivation since commencement of experiment (7 years).	Total value of produce per acre since commencement of experiment (7 years).
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.			
		lbs.	lbs.	lbs.	lbs.	lbs. oz.	lbs. oz.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Linseed...	40	118	19	57	0 7	3 13	0 0 6	4 14 10	36 9 7	11 9 9
II	Linseed...	41	98	...	...	0 3	2 0	0 0 3	4 11 7	43 15 6	35 9 6
	and Gram ...	278	416	273	413	...	...	...	...		
III	Linseed...	35	115	...	...	0 3	1 5	0 0 2	5 4 6	45 4 4	45 9
	and Cotton ...	33	87	100	203	...	...	...	...		
IV	Linseed...	46	143	...	...	0 3	2 0	0 0 3	4 10 8	48 1 0	72 8 7
	and Tur ...	617	1,650	783	1,918	...	...	...	...		

The linseed crop this year was a total failure as it dried up very soon owing to the abrupt cessation of the monsoon. The site of the experiment is high-lying.

FIELD No. 61. SUBJECT.—*Rotations with cotton and tur.*

Plot. I.—Area 0·30 acre. Cotton-tur year after year.
„ II. „ 0·30 „ Cotton-tur in rotation with wheat.
„ III. „ 0·30 „ Cotton-tur in rotation with gram.

Commenced in 1893-94. Unmanured and unirrigated. For cropping, see column 2 below.

No. of plot.	OUTTURN PER ACRE.													Cost of cultivation per acre.	Total outlay in cultivation per acre since commencement of experiment (4 years).	Total value of produce per acre since commencement of experiment (4 years).
	1893-94.			1894-95.			1895-96.			1896-97.						
	Crop.	Grain or lint.	Straw or seed.	Crop.	Grain or lint.	Straw or seed.	Crop.	Grain or lint.	Straw or seed.	Crop.	Grain or lint.	Straw or seed.	Value.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		lbs.	lbs.		lbs.	lbs.		lbs.	lbs.		lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Cotton and Tur	21 / 590	41 / 1,943	Cotton and Tur	12 / 404	31 / 832	Cotton and Tur	54 / 307	109 / 432	Cotton and Tur	14 / 283	26 / 548	2 8 11 / 11 6 2	7 2 5	45 5 6	70 8 4
II	Cotton and Tur	27 / 613	52 / 1,960	Wheat	663	1,010	Cotton and Tur	72 / 532	142 / 768	Wheat	113	297	7 0 4	10 4 5	49 7 4	86 3 2
III	Cotton and Tur	33 / 680	51 / 1,980	Gram	523	837	Cotton and Tur	59 / 352	120 / 567	Gram	219	255	12 0 6	6 11 9	40 9 5	77 8 7

The object of the experiment conducted in this field is to ascertain whether it is more profitable to grow cotton-tur year after year in the same field or, if a rotation is desirable, what is the most suitable crop to raise in the alternate years.

This experiment has now been conducted for four years, and the results indicate that cotton-tur followed by wheat or gram pays better than if cotton-tur be grown without break from year to year. The cost of cultivating gram works out less than that of growing wheat, and though the value of the outturn in the case of the latter is higher the net profits on the two plots do not differ. But this enhanced outlay in the case of wheat over gram is for the most part purely accidental, and is due to the fact that the plot devoted to wheat is abnormally prone to weeds and their eradication costs money. It will also be noticed that the yield of wheat this year was singularly poor.

V.—ROTATION EXPERIMENTS WITH MANURES.

Rotation with manures.

9. There are seven fields in which experiments in manure and rotation are tried.

In fields Nos. 14 and 17 the experiment is designed to bring out the advantage of green manuring on a rotation of wheat and cotton. In the other fields the effect of the various manures—stall-dung, box-dung, bone-dust and lime—was tested on the following crops grown in rotation :—

Juar and linseed, cotton and wheat linseed and cotton.

The field lettered 42 N. was devoted to an experiment to test the effect of phosphatic and potassic manures on tur (a nitrogen-fixing crop) in rotation with wheat. The results which have been obtained this year in the case of each of these experiments are contrasted below with those of previous years.

FIELD NO. 14. SUBJECT.—*Effect of green-manuring with san-hemp (Crotolaria juncea) on wheat with fallow interposed, and on wheat in rotation with cotton.*

Plot I.—Area 0·18 acre. Green-manuring followed by fallow and then by wheat.
„ II. „ 0·18 „ Wheat alternating with fallow, but unmanured.
„ III. „ 0·18 „ Green-manuring followed by wheat and then by cotton.
„ IV. „ 0·21 „ Wheat and cotton in rotation, but unmanured.

Commenced in 1891-92. No green-manuring in year under report. For this year's cropping see column 5 below.

No. of plot.	Crop.	OUTTURN PER ACRE.					TOTAL FROM COMMENCEMENT OF EXPERIMENT (6 YEARS).	
		AVERAGE OF PRECEDING FIVE YEARS, 1891-92 TO 1895-96.		1896-97.			Cost of cultivation including green-manuring.	Value of produce.
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.		
		lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Wheat	697	1,194	41	103	2 8 5	68 3 6	55 14 11
II	Do.	592	724	53	124	3 3 9	46 8 9	46 10 3
III	Wheat and Cotton	445	851	...	...	...	95 7 4	95 1 6
		57	146	35	86	6 11 6		
IV	Wheat and Cotton	486	926	...	...	...	67 9 1	101 15 11
		50	132	71	159	13 6 3		

The above experiment is a double one. One pair of plots is fallow in the year of green-manuring and bears wheat in the following year. The other pair grows wheat after the green-manuring followed by cotton in the next *kharif* season. Wheat was sown in the first two plots on the 4th of October, and was reaped on the 27th January. Cotton was sown in plots Nos. III and IV on the 20th of June. But owing to uneven germination the plots were resown on the 29th June. For the reasons given in last year's Report, the criticism of the results must be postponed to next year when wheat will be grown again under conditions similar to those of 1895-96 in plots Nos. III and IV.

FIELD NO. 17. SUBJECT.—*Effect on wheat and cotton in rotation of green-manuring with (Bawachi), a papilionaceous weed (Psorolia corilifolia).*

Plot I.—Area 0·15 acre. Green-manured with cut weeds every alternate year.

„ II. „ 0·08 „ No manure.

Both plots cropped with cotton and wheat alternately.

Wheat in the year of green-manuring.

Commenced in 1890-91. Unirrigated. Crop, wheat (Nagpur haura) in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Cost of green-manuring per acre.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.				
		Grain or lint.	Straw or seed.	Lint.	Seed.	Grain.	Straw.	Value.		
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Wheat ...	569	1,246	...	...	233	447	13 13 11	11 2 10	11 2 4
	Cotton ...	58	141	134	262	...	...	...	...	...
II	Wheat ...	347	816	...	...	120	192	7 0 1	16 10 8	...
	Cotton ...	43	112	109	208	...	...	...	...	...

The experiment conducted year after year in plots Nos. I and II of this field are the same as those conducted in plots Nos. III and IV of field No. 14, with this difference that the crop ploughed into field No. 14 is san-hemp (*Crotolaria juncea*), while in field No. 17 the green-manuring is with Bawachi (*Psorolia corilifolia*). Wheat was sown on the 5th of October and reaped on the 29th January. Plot No. I was green-manured with the weed, Bawachi, on the 20th of August, and though the manure failed to become thoroughly assimilated owing to the dryness of the season, the outturn of this plot exceeds by 113 lbs. that of plot No. II, which was unmanured. Cotton, which was grown on this plot last year, gave an outturn in excess by 23 per cent. of that grown in plot No. II.

The results of this experiment are hitherto quite consistent and indicate that benefit is derived from green-manuring. But the question of the profitable nature of the practice of green-manuring cannot fairly be judged on the results of a succession of years so unfavourable to wheat culture.

FIELD NO. 42. SUBJECT.—*Relative effect of dung and bone-dust applied each year on juar and linseed grown in rotation.*

Plot I.—Area 0·27 acre. Manured with dung @ 160 maunds per acre.

„ II. „ 0·27 „ Unmanured.

„ III. „ 0·27 „ Manured with bone-dust @ 360 lbs. per acre.

Commenced in 1890-91. Unirrigated. Crop, juar in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Cost of manure per acre.	Gain in value on plot No. II.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					
		Grain.	Straw.	Seed.	Stalks.	Grain.	Fodder.	Value.			
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Juar ...	251	1,902	...	...	681	3,957	49 15 8	*4 0 6	15 15 3	27 3 10
	Linseed ...	112	280	71	160	...	...	...	...	...	...
II	Juar ...	180	1,363	...	...	259	2,021	22 11 10	*4 3 11	...	...
	Linseed ...	100	199	92	193	...	...	...	...	...	...
III	Juar ...	184	1,355	...	...	248	2,235	23 15 1	*3 15 11	3 6 0	1 3 3
	Linseed ...	108	196	88	164	...	...	...	...	...	...

*Excluding cost of watching.

Juar was sown in all the three plots on the 20th of June and reaped on the 15th of December. The juar crop reaped on plot No. I to which stall-dung was applied was a good one; but the application of bone-dust in plot No. III. has not proved of any benefit whatever. It is noticeable that the unmanured plot gave slightly better results this season than the plot manured with bone-dust, while in the previous years the outturns vary but little. The soil of the Farm is rich in phosphates and it remains to be ascertained whether an abundance of phosphates retards the growth of plants. This experiment, so far as it goes, does not point to any loss occasioned by the application of the phosphates.

FIELD No. 44. SUBJECT.—*Relative effect on cotton and wheat in rotation of box-dung, stall-dung and bone-dust.*

Plot. I.—Area 0·27 acre. Manured with stall-dung @ 160 maunds per acre.
„ II. „ 0·27 „ Manured with box-dung @ 240 maunds per acre.
„ III. „ 0·27 „ Unmanured.
„ IV. „ 0·27 „ Manured with bone-dust @ 360 lbs. per acre.
Commenced in 1890-91. Unirrigated. Crop, cotton (jari) in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of Cultivation per acre.	Cost of manure per acre.	Gain in value on plot No. III.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					
		Grain or lint.	Straw or seed.	Grain.	Straw.	Lint.	Seed.	Value.			
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Cotton ...	44	106	...	...	117	283	22 6 4	9 3 10	12 0 7	14 8 10
	Wheat ...	515	897	740	1,030	...	...	...	...	...	...
II	Cotton ...	59	137	...	...	218	493	41 3 1	10 11 3	12 10 4	33 5 7
	Wheat ...	643	958	868	1,321	...	...	...	...	...	...
III	Cotton ...	25	53	...	...	41	99	7 13 6	5 0 1	...	...
	Wheat ...	349	464	279	458	...	...	...	...	...	...
IV	Cotton ...	24	50	...	...	32	70	6 0 2	5 5 2	3 6 0	—1 13 4
	Wheat ...	284	386	242	448	...	...	...	...	...	...

Cotton was sown in all the plots on the 20th of June. The outturn of plot No. II which was manured with box-dung gives the best outturn. Taking 240 lbs. of uncleaned cotton as the outturn of a 16-anna crop, the average outturn of this field would represent annas 46. The outturn of plot No. I which was manured with stall-dung gives a 26-anna outturn. The unmanured and bone-dust plots have yielded very poor results.

The consistent testimony afforded by this experiment to the enriching properties of box-dung is very satisfactory. This year's yield of cotton on the plot receiving box-dung is quite phenomenal, and the average yield of both wheat and cotton in the plot so treated over a series of seven years is far in excess of the outturn of the other plots.

FIELD No. 63. SUBJECT.—*Relative effect on linseed and cotton in rotation of box-dung and stall-dung applied in alternate years only.*

Plot I.—Area 0·30 acre. Manured with box-dung @ 240 maunds per acre.
„ II. „ 0·30 „ Unmanured.
„ III. „ 0·30 „ Manured with stall-dung @ 160 maunds per acre.
Commenced in 1890-91. Unirrigated. No manure in year under report. Crop, linseed in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Gain in value on plot No. II.	Remarks.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.					
		Grain or lint.	Straw or seed.	Lint.	Seed.	Seed.	Stalks.	Value.			
		lbs.	lbs.	lbs.	lbs.	lbs. oz.	lbs. oz.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
I	Linseed ...	87	256	...	...	0 3	0 10	0 0 3	7 0 9	—0 0 2	Germination of linseed was very uneven in this field and hence the outturn is very poor.
	Cotton ...	40	124	165	311	...	...	...	...	...	
II	Linseed ...	103	275	...	...	0 7	2 1	0 0 5	6 1 6	...	
	Cotton ...	31	87	80	151	...	...	...	...	...	
III	Linseed ...	128	332	...	...	0 3	0 10	0 0 3	8 11 2	—0 0 2	
	Cotton ...	38	117	136	273	...	...	...	...	...	

Linseed was sown in all the plots on the 29th of September. The results are so poor that they are not worth while commenting on. In my opinion four causes have combined towards diminishing the yield of linseed in plots Nos. I and III which are manured with box-dung and stall-dung respectively, *viz.*—

(I) The abundance of nitrogen in the soil due to the application of box-dung and stall-dung does not apparently suit this crop.

(II) The exhaustion of the soil due to the cropping of the plot with linseed every alternate year.

(III) Abnormal heat and drought of the year.

(IV) Presence of the weed *Cyperus pertenuis* (vernacular *Lavi*). The small yield of plot No. II may be attributed to a combination of the last three causes.

FIELD No. 65. SUBJECT.—*Effect of liming soils on wheat in rotation with cotton.*

Plot I.—Area 0·43 acre. Manured with lime in 1890-91 (not to be limed again until 1902-03).

„ II. „ 0·43 „ Not manured with lime.

Commenced in 1890-91. Unirrigated. Both plots were manured with dung in year under report. Crop, wheat (haura)—Nagpur.

No. of plot.	Crop.	OUTTURN PER ACRE.							Remarks.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.			
		Grain. or lint.	Straw or seed.	Lint.	Seed.	Grain.	Straw.	Value.	
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	
I	Wheat	557	982	...	...	21	86	1 6 8	
	Cotton	34	92	91	199	...	...	...	
II	Wheat	543	1,230	...	...	50	115	3 0 9	
	Cotton	32	82	75	169	...	...	...	

Wheat was sown in the two plots on the 3rd of October, and reaped on the 28th of January. Both plots were manured with stable-sweepings at the rate of 160 maunds per acre. I had intended to have applied a richer dressing of manure, but my supply was exhausted. In my opinion the poor outturn of plot No. I which was limed and manured is due to the production of heat in the soil by the thorough oxidization of the manure by the lime combined with the high temperature of the year under report. Plot No. II gave a better outturn than plot No. I, partly because it was not manured with lime.

FIELD No. 42N. SUBJECT.—*Effect of potassic and phosphatic manures on tur—a nitrogen-fixing crop.*

Plot I.—(Northern portion) Area 0·14 acre. Manured with powdered bones, 360 lbs. per acre and potassic sulphate, 90 lbs. per acre.

„ II. (Southern portion) „ 0·14 „ Unmanured.

Commenced in the year under report. Crop, tur in rotation with wheat. *This year* tur.

No. of plot.	OUTTURN PER ACRE.			Gain in value on plot No. II.	Remarks.
	Grain.	Stalks.	Value.		
	lbs.	lbs.	Rs. a. p.	Rs. a. p.	
I	756	1,422	31 6 5	+3 11 6	Crop was good in this plot and no plant withered from the unknown disease which always attacks tur on the Farm.
II	656	1,372	27 10 11	...	

The Commissioner of Settlements and Agriculture brought to my notice an article in the *American Agriculturist* of the 22nd February 1896, describing the benefits which a leguminous crop was calculated to derive from potassic and phosphatic manures, and suggested that an experiment should be tried on the Farm. The article referred to is reprodueed below:—

"If the soil is rich in readily available nitrogen, the probability is that a crop of beans and peas wou'd gather but little of that element from the air, but would use what was already at hand in the soil. If the soil is very poor in nitrogen, it may be expected that these plants will gather their supply largely from other sources than the combined nitrogen of the soil. In general it wou'd appear to be rational to apply no nitrogenous fertilizers to these crops, but to supply an abundance of both potash and phosphoric acid."

Accordingly an experiment was started in the above field with a *tur* crop. The result of the experiment shows that the tur derived full benefit from the potash and phosphoric acid, as its yield was larger by 100 lbs. than the unmanured plot. Next year wheat will be sown in both the plots with the object of ascertaining whether the *tur* crop of plot No. I has stored more nitrogen from the atmosphere and thus enriched the field for the future crop of wheat. Wheat requires nitrogenous manures and it has been proved that a rotation of *tur* and wheat is profitable to both crops.

VI.—EXPERIMENTS WITH MIXTURES OF CROPS.

Mixtures of crops.

10. These experiments were started with the object of testing the expediency of the practice of cultivators of the Province in growing crop mixtures. Two fields were allotted for conducting these experiments.

The experiment in field No. 25 of mixing gram and wheat, known in the Nerbudda Valley as *birra*, was commenced in 1890-91; while the experiment of mixing (1) juar and cotton, and (2) cotton and tur, in field No. 55, was begun in 1893-94. The results are given in the tables below:—

FIELD No. 25. SUBJECT.—*Effect of mixing crops, wheat and a leguminous crop (gram).*

Plot I.—Area 0·21 acre. Wheat sown alone.

„ II. „ 0·21 „ Wheat mixed with gram (*Cicer arietinum*).

Commenced in 1890 91. Unmanured and unirrigated. Crop, wheat (Nagpur haura) and gram.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.
		AVERAGE OF PRECEDING FIVE YEARS, 1890 91 TO 1894-95.		1895-96.		1896-97.			
		Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.	
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I	Wheat	420	616	383	478	150	288	8 14 10	8 9 3
II	Wheat	290	458	266	422	93	240	5 12 2	8 14 10
	and								
	Gram	161	275	53	95	62	147	3 10 3	

Wheat was sown in both plots on the 5th of October and reaped on the 29th of January, the latter plot being mixed with gram. Plot No. I was sown at the rate of 100 lbs. of wheat seed to the acre, and produced 150 lbs.; while in plot No. II wheat and gram were sown at 79¾ lbs. and 20¼ lbs. per acre respectively, and produced 93 lbs. of wheat. According to the proportion of the seed sown in each of the plots, plot No. II ought to have yielded at least 119 lbs. of wheat instead of 93, quite apart from any enrichment of the soil resulting from the admixture of the nitrogen-fixing grain. The diminution perceptible this year in the wheat outturn may, I think, be attributed to the larger amount of moisture which was absorbed by the gram which grew alongside of the wheat.

It is the characteristic property of gram to absorb a larger amount of moisture during a dry season and to leave very little for the wheat with which it is associated.

FIELD NO. 55. SUBJECT.—*Effect of mixing crops, the principal one being cotton, with tur and juar.*

Plot III.—Area 0·27 acre. Cotton, jari, alone.
„ IV. „ 0·27 „ Cotton, jari, and tur in the proportion of 6 lines to 2.
„ V. „ 0·27 „ Cotton, jari, and juar in the proportion of 6 lines to 2.
Commenced in 1895-96. Unmanured.

NOTE.—This experiment was originally started in field No. 23, but owing to its water logged situation, no result of value were obtained and the experiment was transferred to this field.

No. of plot.	Crop.	Outturn per acre.					Cost of cultivation per acre.	Gain in value on plot No. III in 1896-97.
		1895-96.		1896-97.				
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.		
		lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
III	Cotton ...	107	202	50	125	9 9 4	4 13 6	
IV	Cotton ...	63	125	23	47	22 5 8	5 12 11	12 12 4
	and							
	Tur ...	487	966	461	717			
V	Cotton ...	49	94	24	57	23 3 8	*4 15 7	13 10 4
	and							
	Juar ...	218	1,346	191	1,050			

* Excluding cost of watching.

The results brought out by the experiment conducted on this field in 1895-96 are corroborated by the results of the year under report. Plot No. IV, which was sown with a mixture of cotton and tur, stands first in point of outturn and profit. Plot No. V in which a mixture of juar and cotton was sown, although giving a larger outturn yielded in point of fact a smaller net profit than plot No. IV, as the juar crop grown as a mixture on plot No. V requires watching which entails considerable expenditure. Parrots, crows and sparrows are very fond of ripening juar.

VII.—EXPERIMENTS WITH TILLAGE.

Tillage.

11. Only one of our experiments falls under this head. It was started in 1890-91 in order to test the practice of the cultivators who merely scarify the ground for sowing wheat.

The field is divided into three plots. The first plot is ploughed every year; the second is scarified (*bakhared*) every year, and the third is ploughed and hoed in alternate years. The results are embodied in the subjoined table.

FIELD NO. 21. SUBJECT.—*Effect of tillage to various depths.*

Plot I.—Area 0·23 acre. Ploughed every year.
„ II. „ 0·23 „ *Bakhared* (scarified) every year.
„ III. „ 0·23 „ Ploughed and *bakhared* in alternate years.
Commenced in 1890-91. Unirrigated and unmanured. Crop, wheat (haura)—Nagpur, in year under report.
Plot No. III was ploughed in the year 1895-96.

No. of plot.	Crop.	OUTTURN PER ACRE.							Cost of cultivation per acre.	Gain in value on plot No. 2.
		Average of preceding five years, 1890-91 to 1894-95.		1895-96.		1896-97.				
		Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.		
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Wheat...	398	761	340	472	76	161	4 9 3	9 0 6	—1 4 5
II	Do. ...	503	1,031	306	459	98	193	5 13 8	9 2 0	...
III	Do. ...	582	1,073	480	712	154	272	9 1 3	9 3 9	+3 3 7

The experience of the past six year sand the results of the year under report go to prove that the best outturn of wheat is obtained from a field which is ploughed every second year and *bakhared* in alternate years. Plot No. III was so treated and shows better outturns than plots Nos. I and II, which were ploughed and *bakhared* every year respectively. A new site has been selected for the purpose of conducting this experiment in order to ascertain whether the same treatment hitherto given to field No. 21 would be equally beneficial to another field differently circumstanced.

VIII.—VARIETY OF CROPS.

Variety of crops.

12. Fifteen different varieties of cotton as detailed below were sown on the Farm during the year :—

(1) Jari
(2) Bani } (local varieties).

(3) Nimari (obtained from the Khandwa Tahsil in the Nimar District).

(4) Upland Georgian.
(5) Tree cotton (*Gossypium hirsutum*) } Nos. (4) and (5) are American varieties, both of which were raised from acclimatized seed.

(6) Garo Hill (grown from seed kindly sent by the Deputy Commissioner, Garo Hills, Assam).

(7) Borneo cotton (grown from acclimatized seed originally received from Dr. George Watt, Reporter on Economic Products to the Government of India).

(8) Cairo cotton (Abbasai) grown from acclimatized seed originally received from Mr. J. B. Fuller, C. I. E., late Director of Agriculture, Egypt.

(9) Egyptian cotton (Mitaffifi) grown from the seed sent by Mr. J. N. Tata, Bombay.

(10) Moreover (six) different varieties of cotton received from Dr. Watt, to whom the seeds were sent by Dr. David of Zagazig were, tried on the Farm.

Experiments were also made with two varieties of maize, *viz.*—

(11) Jaunpur maize grown from acclimatized seed originally received from the Superintendent of Cawnpore Experimental Farm.

(12) Horse-tooth maize grown from seed received from the Superintendent of the Government Botanical Gardens, Saharanpur.

(13) Four different varieties of cow-peas were grown for fodder. The seed was obtained from the Superintendent, Government Botanical Gardens, Saharanpur.

(14) *Sorghum halipense* (Cuba grass) sown from acclimatized seed sent by Dr. J. W. Leather, Agricultural Chemist to the Government of India, was tested as a fodder crop.

FIELDS NOS. 34 and 37. SUBJECT.—*To compare the yield of different varieties of cotton—Garo Hill, Upland Georgian and Nimar.*

Field No. 34.	Field No. 37.
Plot I.—Area 0·16 acre. Manured with 160 maunds Kachera dung per acre.	Plot I.—Area 0·33 acre. Manured with 160 maunds Kachera dung per acre.
„ II. „ 0·16 „ „	„ II. „ 0·33 „ „
„ III. „ 0·15 „ „	„ III. „ 0·33 „ „

No. of plot.	Crop.	OUTTURN PER ACRE.						Remarks.
		STANDARD (No. 34).			DUPLICATE (No. 37).			
		Lint.	Seed.	Value.	Lint.	Seed.	Value.	
		lbs.	lbs.	Rs. a. p.	lbs.	lbs.	Rs. a. p.	
I	Cotton, Garo Hill ...	86	86	12 9 0	66	66	10 7 4	
II	„ Upland Georgian ...	76	178	16 0 0	71	157	14 12 10	
III	„ Nimari ...	114	317	31 0 6	89	249	24 4 4	

In the above fields the yield of the three different varieties of cotton, *viz.*, Garo Hill, Upland Georgian and Nimari was compared. Upland Georgian and Nimari did fairly well considering the extremely dry character of the season. But the Garo Hill variety ceased to produce any new bolls after the first picking. It seems to require a somewhat moist and cold climate. The bolls produced were exceptionally large, nearly double the size of the local jari and were greatly admired by visitors to the Farm. The variety is very rough, short stapled and woolly, being more elastic than the ordinary kind, and it would appear peculiarly suitable on this account for padding garments in cold countries and stuffing pillows, rezais, &c. The percentage of lint to seed by weight is half-and-half, while the ordinary proportion of seed to lint in other varieties is 66 to 33.

Cotton, varieties 3, 4 and 6.

13. Samples of the produce from all the different varieties of cotton were sent to the Manager, Empress Mills, Nagpur, for valuation.

His report is as follows :—

Nimari.—Fine silky, long strong fibre, better than Hinganghat. Value Rs.79 per *boja* of 345 lbs.

Upland Georgian.—Short, rough, weak irregular fibre, better than jari, seems to be mixed either in seed or lint ; some long fibre and some quite short is to be found. Value Rs.60 per *boja* of 345 lbs.

Jari.—Short, weak, rough. Value Rs.53 per *boja* of 345 lbs.

Garo Hill.—Very short rough fibre. Value Rs.45 per *boja* of 345 lbs.

Bani.—Good, long silky strong fibre, as good as best Hinganghat. Value Rs.77 per *boja* of 345 lbs.

Tree.—Fairly long strong fibre, not as good as Hinganghat. Value Rs 65 per *boja* of 345 lbs.

A sample of Garo Hill variety was taken by Mr. Tata to Bombay, and he reports on it as follows :—

"I am glad to inform you that the samp'es of Garo Hill ginned cotton which I had forwarded to our London Agents have been favourably reported upon by our cotton-brokers.

"I think that business can be done in this cotton next year, if the *bojas* can be laid down in Nagpur at the price quoted by you, *i.e.*, Rs 45, or even up to Rs.50.

"I therefore hope that you will grow this cotton during the next season and will also advise the Patel whom I met at your office to do likewise, as I am confident of doing a fair business in it.'

It is not stated in what line business can be done in this variety, but it is presumed that it is of little use for spinning purposes owing to the shortness of its staple.

14. Egyptian cotton seed sent by Mr. Tata was tried as a cold weather crop in six different plots, three of which were irrigated while the other three received no artificial watering. The object of sowing the seed in different months was to ascertain as far as possible at what time the climatic conditions of Egypt can be most closely approached in India.

Cotton, variety No. 9.

Plot No. 1 was sown in September with irrigation.

Plot No. 2 was sown in September without irrigation.

Plot No. 3 was sown in October with irrigation.

Plot No. 4 was sown in October without irrigation.

Plot No. 5 was sown in November with irrigation.
Plot No. 6 was sown in November without irrigation.

The dates of sowing were—

Plots I and II, September 24th.

Plots III and IV, October 20th.

Plots V and VI, November 27th.

The seed was planted and irrigated according to the directions given by Mr. Tata in his memorandum on the growth of Egyptian cotton in India published in 1896.

The plants sown in September, which were irrigated every tenth or fifteenth day, soon began to droop and wither, while the unirrigated plants sown on the same date were in a fairly flourishing condition. I concluded then that the plants were suffering from excess of moisture. I accordingly reduced the number of waterings to once a month up to the end of February, when on the heat becoming exceptionally great I irrigated the plots every twenty days, and in the hot month of May once a fortnight. The effect was surprising. The plants branched freely and every prospect of securing a bumper crop was entertained. But at a crucial stage in their development the green bolls were punctured by innumerable weevils which discoloured and caked the growing fibre. The bolls were thus prevented from coming properly to maturity. The weevils were black and had wings, and were in a copulating stage. The plants were sprayed with solutions of stale-urine, sulphate of copper and tobacco, but these remedies proved inefficacious. Specimens of the insects were sent to Mr. J. N. Tata of Bombay, who

kindly got them identified by the Superintendent, Indian Museum, Calcutta, extract from whose letter is reproduced below:—

"In reply to your letter No. 957, dated 8th instant, forwarding copy of a report and specimens of an insect affecting cotton from the Superintendent, Experimental Farm, Nagpur, I have the honour to state that the insect proves to be a *Lygœid* bug belonging to the species *Oxycarenus lugubris*, Mostch., which has previously been recorded as doing a good deal of damage to cotton in Madras and Ceylon.—*Vide* Indian Museum Notes, Vol. 1, No. 4, page 188, and Vol. 2, No. 1, Pages 32—33."

EXTRACT FROM INDIAN MUSEUM NOTES, VOL. 1, PAGE 188.

Oxycarenus lugubris, Motschulsky.

Stenogaster lugubris, Motsch; Et. Ent. VIII, 1859, p. 108. *Oxycarenus lugubris*' Stal., En. Hem., IV, 1874, p. 141. Elongate, ovate, above depressed, sub-opaque black, humeral spot on hemelytra, sides thereof very narrowly coxœ, last tibiæ in the middle and tarsi more or less whitish: head elongate, triangular, closely rugosely punctured: thorax closely and deeply punctured, semewhat convex, anteriorly attenuated, constricted in the middle: Sentellum triangular, punctured in rows obliquely: hemelytra complete, subrugulose: abdomen shining, impuncate last segment in three canaliculate in the middle, first femora clavate, beneath with long spines, last joint of the antennal subclaviform, second shorter. Long, $1\frac{1}{3}$—$1\frac{2}{3}$; broad, $\frac{1}{2}$—$\frac{2}{3}$".

Hab. Ceylon.

EXTRACT FROM INDIAN MUSEUM NOTES, VOL. II (PAGES 32-33).

From the Superintendent of the Botanical Gardens, Bangalore, were received in March 1890, specimens of the heteropterous insect *Oxycarenus lugubris*, Mostch., of the family *Lygacidæ*, said to have proved injurious to cotton in Seringapatam, where, in the early stages of the growth of the plant, fumigating with tobacco had been found efficacious in keeping down the pest. This insect has previously been reported as injurious in Ceylon, where it infests the ripe cotton pods and discolours and cakes the cotton. Nothing further is known of its habits. The cotton was also said to suffer from the attack of a hemipterous insect probably belonging to the species *Dysdercus cingulatus*. This insect is allied to the "cotton stainer" (*Dysdercus suturellus*) of the United States, where it is said to puncture the cotton bolls and injure the fibre, also puncturing the rind of oranges and causing the fruit to drop. The remedies recommended for the American species have been poisoning the insects by traps of sugarcane trash, mixed with Paris green or destroying them when collected upon piles of cotton seed or orange peel, with hot water or kerosine and soap emulsion. It is extremely doubtful, however, to what extent such remedies will be found practicable in India."

The crops sown in October and November were similarly treated, but suffered likewise great damage from the pest of weevils.

I give below details of the yield of the irrigated plots which were sown at different times:—

Time of sowing.	Area.	Outturn of uncleaned cotton per acre.
	Acres.	lbs.
September	·16	67
October	·15	87
November	·07	121

It will be observed that the outturn improved the later the crop was sown. During the last few months, *i.e.*, since the monsoon burst, these plants have grown to a height of 6 to 7 feet, and as they are now (August 30th) flowering freely, there would seem a possibility of getting some more pickings in October and November. The weevils have for the time being disappeared.

It should be added that the unirrigated plants sown in all three months failed almost entirely to come to maturity, but they kept alive during the hot weather and have grown prodigiously since the rains broke. Their further development is being watched with interest.

Cotton, variety No. 7.

15. The Borneo cotton which, owing to the limited amount of seed available, was grown in one line, did fairly well, and from 17 plants I obtained $7\frac{1}{2}$ lbs. of uncleaned cotton from this species. The fibre was silky to the touch and the staple to all outward appearance satisfactory, but I await the opinion of English experts as to its relative value.

Samples of this cotton, also of the Mitaffifi and Abbasai varieties, were sent to the Manager, Empress Mills, Nagpur, who forwarded them on to Mr. J. N. Tata of Bombay. This gentleman has promised to send the samples to England as there are no experts in India who are able to give an opinion on the quality of staple, &c., of these descriptions of cotton.

Cotton, variety No. 10.

16. The seeds of the six different unidentified varieties of cotton sent by Dr. Watt were sown in June. The characteristics of five out of the six varieties in the matter of foliage and flowers were similar to Cairo cotton. The sixth resembled an American variety, *viz.*, Upland Georgian. The last

named variety is hardy and produced a large number of bolls. The other five varieties are very delicate and their branches began to decay one by one in September after the cessation of the rains. One of the varieties bore no bolls at all during the period of its growth. As I was not furnished with the names of the varieties, I was obliged to send botanical specimens and samples of cotton to Dr. Watt for identification through the Commissioner of Settlements and Agriculture. His reply is awaited.

Maize, variety No. 11.

17. In field No. 39 acclimatized seed of Jaunpur maize was sown to test the effect of early and late sowings. The seed was sown in plot No. 1 on the 20th of May, while in plot No. 2 it was sown on the 25th of June, after the rains had set in. The outturn of the early sown maize was equivalent to a yield of 1,464 lbs. to the acre, and of the later sown crop 1,018 lbs. to the acre. There was then an advantage of 446 lbs. in favour of the early sown crop. In the black soil of the Farm, maize does well when, with the aid if irrigation, it becomes well established prior to the heavy rainfall that as a rule characterizes the month of July.

Maize, variety No. 12.

18. Trial was made of a variety of maize called Horse-tooth, the seed of which was introduced from Saharanpur at the suggestion of the Settlement Commissioner. The plants grew to a great height and afforded a large supply of fodder. The cobs were big and well developed. The grains were pearly white and flat on the top, resembling the shape of a horse's tooth, whence the variety derives its name. The variety comes to maturity somewhat later than the Jaunpur species. Sufficient seed has been collected and a further trial will be given to it next year.

Peas, variety No. 13.

19. Four different varieties of cow-peas (*Vigna catiang var*) were sown. The names are (1) Clay cow-pea, (2) Lady cow-pea, (3) Indian cow-pea, (4) Whip-poor-Will cow-pea. They are more suitable for cultivation in kitchen gardens than as field crops for fodder only. They are cultivated as vegetables in the small plots attached to agriculturists' houses (*baris*) in these Provinces under the name of *barbati* or *chawali*. The stalks are also fed to cattle. There is apparently no particular advantage gained in growing the special varieties abovementioned as a fodder crop as our Central Provinces varieties are much hardier and grow much more freely.

Sorghum, variety No. 14.

20. The seed of *Sorghum halipense* collected from last year's crop was sown in a waste plot. It gave three cuttings up to January, while the local grasses growing close by gave only two cuttings. The grass undoubtedly is a good one to cultivate, but it only thrives well in good deep black soil. It is very difficult to eradicate when it has once established itself in a deep black cotton soil because its underground stems go to a great depth. It stands drought better than the local kinds of grasses. It deserves further attention which it will receive in due course.

IX.—EXPERIMENTS WITH PLANT DISEASES.

Experiments with plant diseases.

21. The experiment noted on page 22 of last year's Report of soaking wheat seed in a solution of sulphate of copper before sowing as a preventive against the attacks of smut was repeated. No smutted ears appeared in any of the fields in which the seed was sown.

22. A field was allotted for the cultivation of eight different varieties of wheat in order to ascertain which particular variety is liable to rust and which variety is rust-resistant. The varieties were :—

1. Katha .. ...
2. Haura ... ... } Local varieties.
3. Pissi ... ...

4. Muzaffarnagar Pissi... Acclimatized seed originally received from N.-W. P.

5. Bold, hard yellow ... Acclimatized seed originally imported from Harda.

6. Bansi ... ... Received from Deputy Commissioner, Hoshangabad.

7. Mundia Pissi ... Received from Messrs. Ralli Brothers' agency, Harda.

8. Jondhala or Dhana ... } Acclimatized seed originally received from Mr. de Brett, I. C. S., Saugor.

But the absence of rust in the year under report prevents me from drawing any conclusion from the experiment.

The new variety received was *Bansi* from the Deputy Commissioner, Hoshangabad, who writes:—

* * * * * * *

"This wheat was introduced, the people say, a few years ago from Nimar, but I can obtain no really satisfactory account of its origin. It is now largely sown in the Seoni Tahsil, where it was first introduced. It was also sown in seven villages of Harda, where the people say they got it from Seoni.

"In appearance, when standing, it is characterised by its black beard, which gives the field, as a whole, an ashy-grey colour. The only other wheat with a similar beard, of which I can hear, is *Bangasya* wheat. Of the latter the Settlement Officer wrote in his Settlement Report of 1865 : '*Bangasya* is rare and is only sown east of the Tawa. It has a black beard.' I have been unable to identify *Bangasya* wheat, and it may be another name for *Bansi*.

"*Bansi* wheat is universally believed to be rust-proof. In one field last year at Nandia in Harda it was surrounded by *pissi*, and while the *pissi* was destroyed by rust, it was untouched.

"This year, in spite of excessive dryness, it has done well, and fields sown with *Bansi* will yield arger crop than any other kind.

"Unlike *Mundia pissi* it commands a good price in the market.

"I therefore think that it is a kind of wheat on which it would be well to make some experiments."

Results of experiments made with the cross-bred wheat, seed received from Mr. Farrer of Lambrigg, New South Wales, Australia.

23. The different varieties received from the source noted in the margin were sown by hand-dibbling in prepared channels in a second class black cotton soil on the 15th October 1896. Before sowing it was found necessary to irrigate the field as the soil had become hardened and unworkable, owing to the abnormal drought of the season. The packets of seed were 29 in number. Of these 26 have produced grain—while the remainder failed to germinate or come to maturity. The seeds germinated on the sixth day from the date of sowing, and when each plant had about five or six leaves, some of them began to turn yellow. On scrutiny it was observed that their stems had been half eaten by some insects which I was unable to identify. Owing to the exceptional drought of the season it was found necessary to irrigate the crop seven times from the time the seed was put in the ground. The dates of watering were as follows:—

22-10-96	..	..	..	19-12-96
15-11-96	..	..	..	21-1-97
6-12-96	..	..	..	23-2-97

6-3-97.

The total rainfall between 22nd November 1896 and 15th February 1897, amounted to 1·41 inches, which was distributed as shown in the margin. On the 26th February the weather was sultry and the sky overcast. On the following day it was observed that a blade of one of the varieties had rust spores on it. On the 28th it spread to the other varieties. The disease made a very speedy progress, and between the 1st and 15th of March almost all varieties within a radius of 20 feet round the central one which was first affected with rust were all covered with rust spores. After this the sky became clear and the spread of the rust spores was checked by the strong sunshine. The plants were watered again on the 6th of March, though they were not in need of irrigation, the object being to discover whether watering encouraged the rust spores to spread. In the event it was observed that rust did spread to a certain extent, and the young side shoots of the wheat plants also showed signs of being affected with fungoid disease. All the varieties received from Mr. Farrer ripen late in comparison with our local Indian varieties, such as *haura*, *katha*, &c. The plants were for the most part decidedly lusty growers. The robust ones tillered so freely that some of them produced as many as 50 or 60 side shoots. The rust having appeared at a late stage in the growth of the plants, no material damage was perceptible in the developed grains. They are plump and not shrivelled. Some of the varieties are likely to command a good price in the market. The experiment will be repeated this year as the experience of one year is quite insufficient upon which to base an opinion as to the rust-resistant properties of the varieties, but it is a significant fact that rust appeared on these plants in this season of drought when there was not a trace of it elsewhere on the Farm.

22nd November 1896...	12 cents.	
23rd Do.	48	„
30th December 1896...	10	„
31st Do. ...	12	„
3rd January 1897 ...	6	„
25th Do. ...	13	„
26th Do. ...	19	„
27th Do. ...	7	„
15th February 1897 ...	14	„
Total ...	1·41	„

24. It was noticed in the Report for 1894-95 (page 13) that healthy looking *tur* plants die for some unaccountable reason before coming to maturity. I have observed this not only on the Farm, but also in cultivators' fields in portions of the Nagpur and

Wardha districts that I have visited when on tour. In 1894-95 the remedy of sprinkling the plants with a decoction of *Adhatoda vasica* (Marathi *Adulsa* and Bengali *Basanti*) proved unsuccessful. This year some seeds were soaked in a solution of sulphate of copper before being sown, but with a similar absence of success.

Cross fertilized wheat.

25. It was mentioned in para. 11 of my report for 1895-96 that by the combination of *haura* and *Mundia pissi* 150 grains were secured. These seeds were sown this year and the plants produced were very healthy and robust. Although they were irrigated along with the Australian varieties raised from seed received by Mr. Farrer they escaped the attack of rust. The grains produced were glossy and plump and the quantity produced is 2 lbs. $3\frac{1}{2}$ oz. This variety will be sown next year and the results watched.

Of the other varieties produced from the combination of *Katha* x *Pissi*, *Mundia* x *Katha*, and *Katha* and *Mundia*, the results obtained are not worth recording as the varieties are not calculated to fetch a good price in the market. The grains are shrivelled and reddish in appearance and contain a great deal of gluten, but very little starch.

X.—METHODS OF CULTIVATION.

Methods of cultivation.

26. The experiment noticed in previous reports for obviating the damage caused to *rabi* crops by trees in their vicinity proved to be a complete success. In this year of abnormal drought, the damage caused both to *rabi* and *kharif* crops by the trees would have been excessive had not trenches been dug.

27. A field was devoted to sugarcane in order to determine whether this crop is best propagated by planting tops or sets. The following table gives the outturn of canes, juice and gur of each plot :—

	Treatment.	Area.	Outturn per acre.		
			Canes.	Juice.	Gur.
		Acres.	lbs.	lbs.	lbs.
1	Sets	·09	62,046	37,830	6,807
2	Tops	·08	71,270	44,461	7,685

It will be observed that the proportion of canes, juice and gur of the plot sown with tops is greater than the plot sown with sets only. The practice followed by the cultivators in these Provinces is to sow sets only and to give the tops and the leaves to the cattle as fodder. The cattle eat the leaves and reject the stems. This is a most wasteful method and entails a large expenditure of cane for seed. The tops should be stripped of their leaves and planted out, the leaves being given to the cattle. If this method is followed it will be necessary to plant the tops as soon as the canes are cut for extraction of the juice. This would entail the attention of the cultivators being divided between the process of sowing and extraction of juice, but they would be more than compensated for their trouble by the saving of the canes which they now set apart for seed purposes. In preparing gur or jaggery the cultivators in these Provinces use a great deal of fuel. This is due to the construction of their iron pans which are made of very thick sheets of iron. If thin instead of thick iron pans were used, fuel would not be necessary except for boiling the juice extracted from the first set of canes. Subsequent extractions of juice can be boiled by dried trash and leaves of the canes which the cattle refuse to eat. The general complaint of cultivators is a want of fuel for the purpose of manufacturing jaggery. This want can be supplied by the use of thin pans. These Provinces at present import a large quantity of gur from outside, which is evidently due to the decrease in the production of jaggery in these Provinces owing to the crude methods of manufacturing the article.

28. In the hot weather mulching the sugarcane crops with dry grass was tried with success similar to that noticed in my Report for 1895-96. If the method of mulching were followed by cultivators, there would be a smaller demand for water in the dry and hot months of April and May, and it would also save the cultivator the expenses of weeding.

29. My attention was drawn by the Commissioner of Settlements and Agriculture to an article on the advantages of the press drill (for wheat) which appeared in the *American Agriculturist*, dated 20th June 1896. I reproduce it below :—

EXTRACT FROM THE "AMERICAN AGRICULTURIST," DATED 20TH JUNE 1896.

Advantages of the Press Drill.

"During the past two years we have frequently called attention to the necessity of thoroughly compacting the ground for wheat,—and in fact any crop,—especially when the season promises to be dry. The last bulletin of the Iowa experiment station corroborates these statements. Adjoining plots were seeded to winter wheat and given similar treatment, except that one was seeded with a common drill and the other a press drill. Threshing returns showed that the plot seeded with a press drill yielded at the rate of 54½ bushels per acre, while the common-drilled plot yielded only 44 bushels. A similar test in 1894 gave a yield of 48 bushels for the press drill and 30 for the common drill. The press drill compacts the soil over the seed, the moisture is retained, and a more vigorous plant results."

An experiment was accordingly tried to test the advantages claimed in the above article.

FIELD NO. 40. SUBJECT.—*To test the effect of Press drill* vs. *Common drill.*

Plot I.—Area 0·12 acre. Seed sown by common drill.

„ II. „ 0·12 „ Seed sown by press drill.

Both plots manured with 160 maunds dung per acre. Crop, wheat (haura)—Nagpur.

No. of plot.	Crop.	Treatment.	Outturn per acre.			Remarks.
			Grain.	Straw.	Value.	
			lbs.	lbs.	Rs. a. p.	
I	Wheat (haura)—Nagpur...	Common drill ...	529	629	30 1 2	
II	Ditto ...	Press drill	500	875	29 7 3	

In plot No. I seed was sown with the ordinary three-tined seed drill. In plot No. II the seed was sown as above, but was afterwards rolled by an iron roller. The results obtained from the plot in which seed was sown without the ground being rolled are better than those obtained from the plot which was rolled. I observed that germination was very thin in the pressed plot and is due, I think, to the seedlings being weak and unable to force themselves through the compressed mass of earth which covered them. Had some slight showers of rain fallen after sowing time, they might perhaps have tended to soften the soil a little so as to allow the plumules to shoot out, but we were not favoured with such showers last cold season.

This experiment will be repeated.

XI.—TRIAL OF IMPLEMENTS.

Implements.

30. All the implements which were tried last year were given a further trial this year. No new implements were tried during the year under report.

XII.—DISTRIBUTION OF SEEDS AND IMPLEMENTS.

(A).—SEEDS.

Distribution of seeds and implements.

31. In the year under report Jaunpur maize seed was distributed to the undermentioned gentlemen :—

(1) Mr. Madho Singh, Manager, Court of Wards, Nagpur.

(2) Khan Bahadur Aulad Husain, C. I. E., Settlement Officer, Seoni.

(3) Mr. C. M. Hathy Daroo, Seoni.

(4) Mr. Parmanand, Assistant Settlement Officer, Mandla.

(5) Tahsildar, Lakhnadon.

To the last-named officer a large quantity of seed, *viz.*, 318lbs. were sent to be distributed among cultivators for being sown in the rains, so that they would have an edible crop in a very short time in these hard days when they are so much pinched for food. It was pointed out to the Tahsildar to whom the seed was sent that the fields that would be devoted to this crop would also be available for any of the *rabi* sowings.

Guinea grass shoots for planting out on nala sides to supply fodder were supplied to the following gentlemen :—

(1) Mr. Madho Singh, Manager, Court of Wards, Nagpur.

(2) Mr. Gangadhar Madho Chitnavis, C. I. E.

(3) Mr. Hassan Khan, Assistant Settlement Officer, Bhandara.

(4) Deputy Commissioner, Balaghat.

(5) Manager, Court of Wards, Mandla.

Varieties of cotton and linseed, &c., were supplied to the following gentlemen :—

(1) Director of Land Records, North-Western Provinces and Oudh.

(2) Mr. Madho Singh, Manager, Court of Wards, Nagpur.

(3) Rikhi Ram, Naik of Bilheri in the Murwara Tahsil of the Jubbulpore District.

(4) Thakur Hanuman Singh, Talukdar of Barwara, Jubbulpore District.

(5) Pandit Hanuman Prasad, Malguzar of Bijeraghogarh, Jubbulpore District.

(6) Mr. Abirchand, Malguzar of Sadda, Jubbulpore District.

(B).—IMPLEMENTS.

A Swedish plough was given for trial to the Tahsildar, Lakhnadon.

A hand-thresher was lent to the Roman Catholic Fathers for trial on the Mission Farm at Thana near Bori.

(C).—SUGAR-CANE MILLS.

Four mills were given on hire to cultivators for one season. The Baby Cream Separator which was lent to the Superintendent, Lunatic Asylum, has, it is understood, proved of advantage to that institution.

XIII.—CATTLE BREEDING.

Cattle breeding.

32. The Mysore bull kept at the Farm is gaining in popularity and Gaolis and residents of the station send their cows to him. The other bull sent to Rahati, a village belonging to Musammat Lachmi Bai Naikin under the management of the Court of Wards, Nagpur, unfortunately died of rinderpest.

XIV.—EXPERIMENTS WITH FODDER AND FOREST RESERVES.

Fodder and Forest.

33. The seedlings of all the jungle trees planted in the year are still alive. But the abnormal heat of the year scorched them severely and it remains to be seen whether they will revive in the rains. Many bamboo clumps and old mango trees died during the year owing to drought.

The Farm and gardens continue to draw their supply of grass from the Reserve. The receipts and expenditure of the Reserve are as follows :—

Expenditure.

	Rs.	a.	p.
Pay of 2 chowkidars in 1896-97	140	7	9
Receipts.			
(1) Value of grass supplied to the Farm and garden ..	280	0	0
(2) Do. do. disposed of by auction	130	0	0
	410	0	0
(3) Deduct cost of establishment	140	7	9
Net profit Rs. ..	269	8	3

No steps were taken to irrigate the trees in a portion of the Reserve in the year under report as there are no means of irrigating them unless a well is sunk in the Reserve.

XV.—SEWAGE FARM.

Sewage Farm.

34. There is nothing new or noteworthy to be mentioned this year about this institution. The sewage was deposited as usual in pits six feet deep. Four feet of sewage are covered with two feet of *kachra*. After a year the poudrette is removed by hand and carted to the Kachis' plots. The handling of the sewage necessitated by this method is open to many objections. Moreover irrigation is indispensable to this method of disposing of sewage. I have accordingly been experimenting in the Farm on the lines of the system initiated by Conductor Meagher at Allahabad. The principal features of this system are that the trenches are only four inches deep and only two inches of sewage are deposited therein and covered with earth. In this way the surface of exposure is very large and oxidization takes place so rapidly that a field treated in February or March can be used for *kharif* cultivation in June. Another important point is that there is no handling of the sewage when once pitted. It is absorbed where it lies.

Hitherto coolies were employed in digging the shallow trenches for the storage of night-soil, but I have by experiment ascertained that this labour can be saved by the use of two planks fastened together and shaped in the form of the letter V. This implement is drawn easily, point foremost, by a pair of bullocks and trenches of sufficient depth to receive the night-soil that would be carted to the field during a fortnight can be formed in 4 hours' time. The Secretary, Municipal Committee, Nagpur, saw this implement being used and has introduced it in the fields owned by the Municipality.

There seems little doubt that fields are much recuperated by the sewage thus applied. In the year under report I grew a mixed crop of cotton, *juari*, *bajri*, and *ambari* on the plot so treated. The millets grew most luxuriantly and so did the cotton, which yielded 243 lbs. of uncleaned cotton to the acre. The land was too rich for *ambari*, which cannot stand too much nitrogenous manure. Regular experiments on the same lines are being conducted this year with cotton and juar unmixed, and the results will be carefully recorded under the head of Manure Experiments in my next report.

XVI.—AGRICULTURAL CLASS.

Agricultural class.

35. The working of the Agricultural class has been separately reported upon. The year opened with four senior students. Thirteen new students joined the Junior class, of whom two had passed the Entrance Examination and eleven the Middle School. Three were scholarship-holders. Practical field work was as usual insisted upon. The senior students cultivated both *kharif* and *rabi* crops on the half acre plots allotted to them and the juniors cultivated only *rabi* crops on their quarter-acre plots. The total area under cultivation was $5\frac{1}{4}$ acres and the students realized Rs.74-11-3 by the sale of their crops, each one appropriating the value of the produce of his own plot.

The annual examination papers were set by the under-mentioned gentlemen :—

Dr. J. W. Leather, Agricultural Chemist to the Government of India—Agriculture.

Rev. Dr. A. Robertson, M. B., Principal, Hislop College—Botany, Geology and Chemisty.

Mr. R. K. Indurkar, Superintendent of Land Records, Nagpur—Surveying.

Mr. C. Pillay, Veterinary Inspector—Veterinary.

I examined the students in practical agriculture such as ploughing, harrowing, &c.

Four senior and seven junior students passed the Final Examination. Tatya Herumb, who stood first on the list of successful candidates of the senior class, secured the Silver Medal. Seven out of thirteen juniors were promoted to the second year's course, and three have been permitted to continue their studies in the junior class. The remaining students, three in number, have not worked sufficiently hard to justify their retention in the school.

In the Normal Agricultural class for village schoolmasters, there were thirty-one masters during the first term, of these twenty-five masters passed the examination and obtained certificates. During the second term there were thirty-five masters, all of whom passed the prescribed examination. One Nanhu Ram of Balaghat, who stood first in the Final Examination, showed special merit which did not go unrecognized.

XVII.—MISCELLANEOUS.

Miscellaneous.

36. During the year under report the following collections were made for the Imperial Institute :—

(*a*) Mustard-oil, oilcake and seed.

(*b*) Sirguja-oil, oilcake and seed.

(*c*) Linseed-oil, oilcake and seed.

(*d*) Safflower-oil, oilcake and seed.

(*e*) Mahua-oil, oilcake and seed.

(*f*) Chironji seed.

(*g*) Botanical specimens of *Coix Lachryma.*

(*h*) Botanical specimens of *Ammania Bacifera.*

(*i*) Lichens.

(*j*) Nagarmothe.

(*k*) Lathyrus-seed.

(*l*) Al-roots and Botanical specimens.

37. At the request of Dr. Leather I have undertaken to make some experiments on the weight of soils, the amount of moisture generally present in different soils under varying circumstances and the temperature of soils at certain depths during the year.

XVIII.—FINANCIAL RESULTS.

38. The expenditure and receipts of the year are shown below :—

	Expenditure.			Receipts.	Net cost.
	Salaries.	Contingencies.	Total.		
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Budget	4,524 0 0	4,800 0 0	9,324 0 0	2,050 0 0	7,274 0 0
Actuals	3,790 9 0	2,605 12 0	6,396 5 2	3,129 10 10	3,266 10 4

A detailed statement showing the various items of receipts and expenditure is printed as Annexure E. The figures of 1895-96 are contrasted.

I have the honour to be,

SIR,

Your most obedient Servant,

R. S. JOSHI,

Superintendent, Government Experimental Farm,

Nagpur.

LIST OF ANNEXURES.

A.—Statement showing the total areas under cultivation on the Experimental Farm, Nagpur, during 1896-97.

B.—Statement showing the average rates of the cost of cultivation on the Experimental Farm, Nagpur, during 1896-97.

C.—Statement showing the rates used for valuing the produce of the Experimental Farm, Nagpur, during 1896-97.

D.—Programme of experiments as it stood on the 1st June 1897.

E.—Comparison of receipts and expenditure of 1896-97 with that of 1895-96.

Annexure A.

Total area under cultivation on the Experimental Farm, Nagpur, during the year 1896-97.

Crop.	Area.	Total.	Grand Total.
A.—EXPERIMENTAL AREA.	Acres.	Acres.	Acres.
(1) *Kharif*—			
Cotton alone	3·32		
Cotton and tur	·57		
Cotton and juar	·27		
Juar	·81		
Maize	·56		
Tur	·46		
Til	·70	6·69	
(2) *Rabi*—			
Cotton (Egyptian)	·98		
Wheat	10·22		
Wheat and gram (birra)	·21		
Gram	·30		
Linseed	3·87		
Mustard	·80		
Safflower	·65	17·03	23·72
B.—NON-EXPERIMENTAL AREA.			
(1) *Kharif*—			
Cotton	3·01		
Cotton and tur	5·68		
Juar	3·03		
Sorghum	1·42		
Tur	14·04		
Popat	·21		
Til	4·18		
San-hemp	·81		
Jagnee	·16	32·54	
(2) *Rabi*—			
Wheat	2·62		
Wheat and gram (birra)	1·33		
Linseed	1·01		
Gram	3·34		
Oats	2·50		
Safflower	·74	11·54	44·08
GRAND TOTAL	...	...	67·80

Annexure B.

Statement showing the average cost per acre of each operation of cultivation on the Experimental Farm, Nagpur, during the year 1896-97 as deduced from the Field Cultivation Book.

[NOTE.—The hire of a pair of bullocks is taken as 12 annas; of a male cooly 3 annas; of a female cooly 1½ annas and of a child 1 anna.]

Class of operation.	Detail.	Rate per acre. Rs. a. p.	Explanation.
Cost of tillage	Ploughing by Swedish plough	1 10 5	A pair of bullocks and a man for 1·76 days.
	Hoeing by bakhar (bullock hoe)	0 10 2	Do. do. for ·67 day.
	Weed hoeing by daura (small bullock weeding hoe)	0 4 6	Do. and two men for ·25 day.
	Do. by dundia (large do.) ...	0 6 1	Do. do. for ·33 day.
	Weeding by hand	0 5 5	10 women for ·36 day.
Cost of sowing, including cost of seed.	Cotton by argarha (country drill hoe) ...	0 7 2	16 lbs. of seed (Re.0-3-2). A pair of bullocks and a man and 3 women for ·20 day.
	Tur do. do.	0 11 8	17 lbs. of seed (Re.0-6-9). A pair of bullocks and a man and 3 women for ·25 day.
	Juar by tifan (country drill)	0 9 5	14 lbs. of seed (Re.0-5-9). A pair of bullocks and 2 men for ·20 day.
	Gram by nari-nager (drill plough)	1 12 0	40 lbs. of seed (Re.1-5-4). A pair of bullocks and 2 men for ·37 day.
	Linseed by tifan (country drill)	1 6 2	13 lbs. of seed (Re.0-11-4). Two pairs of bullocks and 3 men for ·32 day.
	Wheat by nari-nager (drill plough)	4 6 7	100 lbs. of seed (Re.3-8-0). Two pairs of bullocks and 3 men for ·44 day.
Cost of manure (excluding loading, carting and spreading).	Saltpetre	16 11 0	240 lbs. @ Rs.5-9-0 per maund.
	Bone-dust	3 6 0	360 lbs.; cost of collecting annas 8 per maund and of crushing annas 4 per maund.
	Cattle-dung	10 0 0	160 maunds @ anna 1 per maund.
	Ashes of dung	11 0 8	160 maunds dung @ anna 1 per maund and drying and burning dung for ashes Re.1-0-8 per acre.
	Green-manuring with san-hemp	8 9 6	100 lbs. of seed (Rs.2-3-10); sowing broadcast (Re.0-0-10); covering seed by harrow (Re.0-6-8) and cutting and ploughing (Rs.5-14-2).
	Green-manuring with bawachi (*Psoralia corilifolia*)	11 2 4	Cutting and carting bawachi (Rs.8-7-7) and ploughing (Rs.2-10-9).
Cost of harvesting.	Picking cotton	0 4 8	2 women for 1·55 days each picking
	Reaping juar	0 8 10	8 Do. for ·73 day.
	Do. gram	0 3 10	7 Do. for ·36 „
	Do. linseed	0 3 11	5 Do. for ·52 „
	Do. wheat	0 5 11	4 Do. for ·98 „
Cost of threshing and cleaning.	Ginning cotton	2 4 2	2 men and 1 woman for 4·82 days; average produce per acre 286 lbs. of seed cotton.
	Threshing and cleaning juar	1 8 1	1 man and 1 woman for 5·35 days; average produce per acre 396 lbs. of grain and 2,738 lbs. of karbi.
	Do. gram	0 8 11	4 bullocks, 1 man, 2 women and 2 boys for ·27 day; average produce per acre 219 lbs. of grain and 255 lbs. of straw.
	Do. linseed	0 14 6	4 bullocks, 1 man, 2 women and 2 boys for ·45 day; average produce per acre 134 lbs. of grain and 394 lbs. of stalks.
	Do. wheat	0 11 6	4 bullocks, 1 man, 3 women and 2 boys for ·34 day; average produce per acre 224 lbs. of grain and 365 lbs. of straw.

Annexure C.

Statement showing the Rates used for valuing the produce of the Experimental Farm, Nagpur, during the year 1896-97.

Name of produce.		Value.		Remarks.
		Rate.	Per	
		Rs. a. p.		
Cotton lint (according to quality)		79 0 0	Bojha of 345 lbs.	
		77 0 0		
		65 0 0		
		60 0 0		
		53 0 0		
		45 0 0		
Cotton seed		10 0 0	Khandi of 640 lbs.	
Juar	Grain	12 4 0	„ of 390 lbs.	
	Karbi	25 0 0	Sheaves 1,000 ...	About 3,460 lbs.
Tur	Grain	15 0 0	Khandi of 421 lbs.	
	Stalks	0 12 0	8 bundles	About
	Bhusa	1 8 0	One cart-load ...	About 478 lbs.
Gram	Grain	20 0 0	Khandi of 390 lbs.	
	Chaff	1 8 0	One cart-load ...	About 478 lbs
Linseed (chaval-katha) ...	Grain	19 0 0	Khandi of 385 lbs.	
	Stalks and bhusa ...	1 8 0	One cart-load ...	About 478 lbs.
Wheat (haura)—Nagpur ...	Grain	21 0 0	Khandi of 400 lbs.	
	Straw	1 12 0	One cart-load ...	About 478 lbs.

Annexure D.

EXPERIMENTAL FARM, NAGPUR.

Programme of Experiments as it stood on the 1st June 1897.

No. of field.	Purpose of Experiment.	Crop. 1st year.	Crop. 2nd year.	Crop. 3rd year.	Special treatment. 1st year.	Special treatment. 2nd year.	Special treatment. 3rd year.	Year (commencing June) in which experiment started.	Remarks.
				Manure Experiments.					
A—1	Effect on wheat grown continuously of different kinds of manures applied year after year with irrigation.	Wheat ...	Wheat ...	Wheat ...	Saltpetre ...	Same as in first year.	Same as in first year.	1883 ...	Cropping and treatment.
—2		Do. ...	Do. ...	Do. ...	Bone-dust ...	Do. ...	Do. ...		Similar every year.
—3		Do. ...	Do. ...	Do. ...	Saltpetre and bone-dust...	Do. ...	Do. ...		Quantities per acre.
—4		Do. ...	Do. ...	Do. ...	Cattle-dung ...	Do. ...	Do. ...		Saltpetre 240 lbs.
—5		Do. ...	Do. ...	Do. ...	Dung and bone-dust ...	Do. ...	Do. ...		Bone-dust 360 lbs.
—6		Do. ...	Do. ...	Do. ...	Ashes of dung ...	Do. ...	Do. ...		Cattle-dung 160 mds.
—7		Do. ...	Do. ..	Do. ...	*Nil.* ...	Do. ...	Do. ...		Ashes of 160 mds. dung.
—8		Do. ...	Do. ...	Do. ...	San-hemp ploughed in green.	Do. ...	Do. ...		
B—1	Do. without irrigation ...	Wheat ...	Wheat ...	Wheat ...	Saltpetre ...	Same as in first year.	Same as in first year.	1890 ...	Do. do.
—2		Do. ...	Do. ...	Do. ...	Bone-dust ...	Do. ...	Do. ...		
—3		Do. ...	Do. ...	Do. ...	Saltpetre and bone-dust...	Do. ...	Do. ...		
—4		Do. ...	Do. ...	Do. ...	Cattle-dung ...	Do. ...	Do. ...		
—5		Do. ...	Do. ...	Do. ...	Dung and bone-dust ...	Do. ...	Do. ...		
—6		Do. ..	Do. ...	Do. ...	Ashes of dung ...	Do. ...	Do. ...		
—7		Do. ...	Do. ...	Do. ...	*Nil* ...	Do. ...	Do. ...		
—8		Do. ...	Do. ...	Do. ...	San-hemp ploughed in green.	Do. ...	Do. ...		
C—1	Effect on linseed grown continuously of different kinds of manures applied year after year.	Linseed ...	Linseed ...	Linseed ...	Saltpetre ...	Same as in first year.	Same as in first year.	1895 ...	Cropping and treatment similar every year.
—2		Do. ...	Do. ...	Do. ...	Bone-dust ...	Do. ...	Do. ...		
—3		Do. ...	Do. ...	Do. ...	Tarota to be ploughed in green.	Do. ...	Do. ...		
—4		Do. ...	Do. ...	Do. ...	Cattle-dung ...	Do. ...	Do. ...		
—5		Do. ...	Do. ...	Do. ...	Bawachi to be ploughed in green.	Do. ...	Do. ...		
—6		Do. ...	Do. ...	Do. ...	Ashes of dung ...	Do. ...	Do. ...		
—7		Do. ...	Do. ...	Do. ...	*Nil* ...	Do. ...	Do. ...		
—8		Do. ...	Do. ...	Do. ...	San-hemp ploughed in green.	Do. ...	Do. ...		
Ville—1	Practical method of soil analysis by using chemical manures, as devised by M. Georges Ville.	Linseed ...	Linseed ...	Linseed ...	Amm. Chlor. cal. Superphos : pot. sulph. and cal. sulph.	Same as in first year.	Same as in first year.	1895 ...	Cropping and treatment similar every year.
—2		Do. ...	Do. ...	Do. ...	As in 1 less cal. superphos.	Do. ...	Do. ...		Quantities per acre.
—3		Do. ...	Do. ...	Do. ...	As in 1 less amm. chlor.	Do ...	Do. ...		Amm. chlor. 140 lbs.
—4		Do. ...	Do. ...	Do. ..	No manure.	Do. ...	Do. ...		Cal. cuperphos. 180 lbs.
—5		Do. ...	Do. ...	Do. ...	As in 1 less potassic sulphate.	Do. ...	Do. ...		Potassic sulphate 90 lbs.
—6		Do. ...	Do. ...	Do. ...	As in 1 less calcic sulphate.	Do. ...	Do. ...		Calcic do. 100 lbs.

18—1		Wheat ...	Wheat ...	Wheat ...	Psorolia corilifolia to be sown and ploughed in green.	Same as in first year.	Same as in first year.	1890 ...	Cropping and treatment similar every year.
—2	Relative effect of green-manuring, box-dung and stall-dung.	Do. ...	Do. ...	Do. ...	*Nil.* ...	Do. ...	Do. ...		
—3		Do. ...	Do. ...	Do. ...	Box-dung ...	Do. ...	Do. ...		
—4		Do. ...	Do. ...	Do. ...	Stall-dung ...	Do. ...	Do. ...		
32—1	Effect on wheat of green-manuring with papilionaceous weeds (*Psorolia corilifolia*).	Wheat ...	Wheat ...	Wheat ...	Green-manuring with weeds cut from waste land.	Same as in first year.	Same as in first year.	1891 ...	Do.
—2		Do. ...	Do. ...	Do. ...	*Nil.* ...	Do. ...	Do. ...		
23—1	Effect on wheat of manuring with saltpetre in different rates per acre without irrigation.	Wheat ...	Wheat ...	Wheat ...	*Nil.* ...	Same as in first year.	Same as in first year.	...	Duration of the experiment is of two years only.
—2		Do. ...	Do. ...	Do. ...	Saltpetre 240 lbs. per acre.	Do. ...	Do. ...		
—3		Do. ...	Do. ...	Do. ...	Do. 80 lbs. per acre.	Do. ...	Do. ...		
68—1	Do. with irrigation ...	Wheat ...	Wheat ...	Wheat ...	*Nil.* ...	Same as in first year	Same as is first year.	...	Do.
—2		Do. ...	Do. ...	Do. ...	Saltpetre 240 lbs. per acre.	Do. ...	Do. ...		
—3		Do. ...	Do. ...	Do. ...	Do. 80 lbs. per acre.	Do. ...	Do. ...		
15—1	To test the effect of manuring at different times of the year.	Wheat ...	Wheat ...	Wheat ...	Manured with dung in June.	Same as in first year.	Same as in first year.	...	Duration of the experiment is of three years only.
—2		Do. ...	Do. ...	Do. ...	Manured with dung in August.	Do. ...	Do. ...		
55—1	Do. ...	Wheat ...	Wheat ...	Wheat ...	Manured with dung in June.	Same as in first year.	Same as in first year.	...	Do.
—2		Do. ...	Do. ...	Do. ...	Manured with dung in August.	Do. ...	Do. ...		
9—1	To test the effect of phosphatic manures on different oil-seeds suggested by Dr. Leather.	Linseed and Mustard.	Linseed and Mustard.	Linseed and Mustard.	*Nil.* ...	Same as in first year.	Same as in first year.	...	Duration of the experiment is of two years only.
—2		Do. ...	Do. ...	Do. ...	Saltpetre ...	Do. ...	Do. ...		
—3		Do. ...	Do. ...	Do. ...	Burnt bones ...	Do. ...	Do. ...		
—4		Do. ...	Do. ...	Do. ...	Raw bones ...	Do. ...	Do.		
—5		Do. ...	Do. ...	Do. ...	Raw bones and saltpetre.	Do. ...	Do. ...		
59—1	Do. ...	Til and Kardi ...	Til and Kardi ...	Til and Kardi ...	*Nil.* ...	Same as in first year.	Same as in first year.	...	Do.
—2		Do. ...	Do. ...	Do. ...	Saltpetre ...	Do. ...	Do. ...		
—3		Do. ...	Do.	Do. ...	Burnt bones ...	Do. ...	Do. ...		
—4		Do. ...	Do. ...	Do. ...	Raw bones ...	Do. ...	Do. ...		
—5		Do. ...	Do. ...	Do. ...	Raw bones and saltpetre.	Do. ...	Do. ...		
50	To test the effect of last year's poudrette manured after Meagher system.	Til	Til ...	Til ...	*Nil.* ...	*Nil.* ...	*Nil.* ..	...	Duration of the experiment is of one year only.
42N—N	To test the effect of potassic and phosphatic manures of last year on wheat.	Wheat ...	Wheat ...	Wheat ...	*Nil* ...	*Nil.* ...	*Nil.* ...	...	Do.
42N—S		Do. ...	Do. ...	Do. ...	Do. ...	Do. ...	Do. ...		
65—1	Effect of liming soils ...	Wheat ...	Cotton ...	Wheat ...	Caustic lime ...	*Nil.* ...	*Nil.* ...	1890	No. 1 was limed in 1890-91 and another application of lime to be made after 12 years. The crops to be in rotation and manures, especially organic ones, to be applied to both the plots equally occasionally.
—2		Do. ...	Do. ...	Do. ...	Do. ...	Do. ...	Do. ...		

Annexure D.—(*concld.*)

No. of field.	Purpose of Experiment.	Crop. 1st year.	Crop. 2nd year.	Crop. 3rd year.	Special treatment. 1st year.	Special treatment. 2nd year.	Special treatment. 3rd year.	Year (commencing June) in which experiment started.	Remarks.
				Experiments with mixtures of Crops.					
55—3	Effect of mixing crops, the principal one being cotton.	Cotton.							
—4		Cotton and tur in the proportions of 6 lines to 2 cotton, cotton and juar in the proportion of 6 lines to 2.	Same as in first year.	Same as in first year.	*Nil.* ...	*Nil.* ...	*Nil.* ...	1895	Cropping similar every year. Manure to be applied occasionally.
—5			Do. ...	Do. ...	Do. ...	Do. ...	Do. ...		
			Do. ...	Do. ...	Do. ...	Do. ...	Do. ...		
25—1	Effect of mixing crops, wheat and a leguminous crop (gram).	Wheat ...	Wheat ...	Wheat ...	*Nil.* ...	*Nil.* ...	*Nil.* ...	1890	Do.
—2		Wheat and gram ...	Wheat and gram.	Wheat and gram.	Do. ...	Do. ...	Do. ...		
				Experiments with Tillage.					
21—1	Effect of tillage to various depths.	Wheat ...	Wheat ...	Wheat ...	To be ploughed every year			1890	Cropping and treatment similar every year.
—2		Do. ...	Do. ...	Do. ...	To be hoed (bakhared) every year				
—3		Do. ...	Do. ...	Do. ...	Ploughed and bakhared in alternate years				
22—1	Do. ...	Wheat ...	Wheat ...	Wheat ...	To be ploughed every year			1897	Do.
—2		Do. ...	Do. ...	Do. ...	To be hoed (bakhared) every year				
—3		Do. ...	Do. ...	Do. ...	To be ploughed every third year, being hoed during the other two.				
				Variety of Crops.					
60.	To test the yield of varieties of cotton.	Cotton Garo Hill, Upland Georgian, Nimari, Jari, Bani, Tree, Borneo, Cairo, Abbasai and Mitaffifi.	Same as in first year.	Same as in first year.	Manured with Meagher system			...	Duration of the experiment is of one year only.
41 & 43	To test the yield of varieties of wheat.	Wheat—Haura, Katha, Muzaffarnagar, Bansi, Mundia pissi, Nagpur pissi, Jondhala, Bold hard yellow and American wheat cross-fertilized.	Same as in first year.	Same as in first year.	Manured with kachera dung			...	Do.
53	To test the yield of varieties of juar.	Different varieties.	Same as in first year.	Same as in first year.	*Nil.* ...	*Nil.* ...	*Nil.* ...	...	Do.

39	To test the yield of varieties of maize.	Maize Jaunpur and Horse-tooth.	Same as in first year.	Same as in first year.	Manured with poudrette ...	...	...	...		Duration of the experiment is of one year only.
40	To test the yield of Ringni juar ...	Ringni juar ...	Same as in first year.	Same as in first year.	*Nil.* ...	*Nil.* ...	*Nil.* ...	...		Do.
				Experiments with Plant Diseases.						
44N—S. 44N—N.	To test the effect of potassic sulphate *vs.* hot water on smut of wheat.	Wheat ... Do. ...	Wheat ... Do. ...	Wheat ... Do. ...	Hot water ... Potassic sulphate ...	Same as in first year. Do. ...	Same as in first year. Do. ...	...		Do.
				Rotation Experiments without Manures.						
29—1 —2 —3 —4 —5	Effect of rotations with wheat ...	Wheat ... Do. ... Do. ... Do. ... Do. ...	Wheat ... Fallow ... Gram ... Juar and tur ... Kodon ...	Wheat ... Do. ... Do. ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ... Do. ... Do. ...	*Nil* ... Do. ... Do. ... Do. ... Do. ...	1890 ...		Two year rotation, *i.e.*, the fourth year will follow the second.
57—1 —2 —3 —4	Effect of rotations with linseed...	Linseed ... Do. ... Do. ... Do. ...	Linseed ... Gram ... Cotton ... Tur ...	Linseed ... Do. ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ... Do. ...	1890 ...		Do.
61—1 —2 —3	Effect of rotations with cotton ...	Cotton and tur ... Do. ... Do. ...	Cotton and tur... Wheat ... Gram ...	Cotton and tur... Do. ... Do. ...	*Nil.* ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ...	1893 ...		Do.
				Rotation Experiments with Manures.						
14—1 —2 —3 —4	Effect of green-manuring with san-hemp. (On wheat with fallow interposed, on wheat in rotation with cotton.)	Fallow ... Do. ... Wheat ... Do. ...	Wheat ... Do. ... Cotton ... Do. ...	Fallow ... Do. ... Wheat ... Do. ...	Green-manuring with san-hemp. *Nil.* ... Green-manuring with san-hemp. *Nil.* ...	*Nil* ... Do. ... Do. ... Do. ...	Green-manuring with san-hemp. *Nil.* ... Green-manuring with san hemp. *Nil.* ...	1890 ...		Cropping and treatment similar every year.
17—1 —2	Effect on wheat and cotton in rotation of green-manuring papilionaceous weeds (*Psorolia corilifolia.*)	Wheat ... Do. ...	Cotton Do. ...	Wheat ... Do. ...	Green-manuring with weeds cut from waste land. *Nil.* ...	Do. ... Do. ...	Green-manuring with weeds cut from waste land. *Nil.* ...	1890 ...		Do.
42—1 —2 —3	Relative effect of dung and bone-dust applied each year on juar and linseed grown in rotation.	Juar ... Do. ... Do. ...	Linseed ... Do. ... Do. ...	Juar ... Do. ... Do. ...	Dung ... *Nil.* ... Bone-dust ...	Dung ... *Nil.* ... Bone-dust ...	Dung ... *Nil.* ... Bone-dust ...	1890 ...		Manures continued every year; crops to be in rotation.
44—1 —2 —3 —4	Relative effect on cotton and wheat in rotation of box-dung, stall-dung and bone-dust.	Cotton ... Do. ... Do. ... Do. ...	Wheat ... Do. ... Do. ... Do. ...	Cotton ... Do. ... Do. ... Do. ...	Stall-dung ... Box-dung ... *Nil.* ... Bone-dust ...	Stall-dung ... Box-dung ... *Nil.* ... Bone dust ...	Stall-dung ... Box-dung ... *Nil.* ... Bone-dust ...	1890 ...		Do.
63—1 —2 —3	Relative effect on linseed and cotton in rotation of box-dung and stall-dung applied in alternate years only.	Linseed ... Do. ... Do. ...	Cotton ... Do. ... Do. ...	Linseed ... Do. ... Do. ...	*Nil.* ... Do. ... Do. ...	Box-dung ... *Nil.* ... Stall-dung ...	*Nil.* ... Do. ... Do. ...	1890 ...		To be manured with the same kinds of manure every alternate year and crop to be in rotation.

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Annexure E.

Statement showing the details of Receipts and Expenditure of the Experimental Farm, Nagpur, during the year 1896-97.

Receipts.	1895-96.	1896-97.	Remarks.
	Rs. a. p.	Rs. a. p.	
Commercial sale of grain ...	785 6 1	1,036 8 2	Increase is due to the sale of produce of old Model Farm fields Nos. 40 and 43 cultivated by Government.
Distribution of ... Seeds ...	8 0 0	11 12 0	
Distribution of ... Implements ...	185 5 9	98 14 4	
Rent of Government land ...	952 13 6	830 0 3	
Sewage Farm	589 12 11	773 11 6	Increase is due to the rent of encroached land by Kachis.
Miscellaneous	376 2 6	378 12 7	
Total ...	2,897 8 9	3,129 10 10	

Expenditure.	1895-96.	1896-97.	Remarks.
	Rs. a. p.	Rs. a. p.	
Purchase of seeds and plants ...	2 13 0	72 8 0	
Repairs of premises	386 1 8	16 12 0	
Postage	15 6 0	10 1 0	
Service telegrams	...	...	
Country Stationery	0 10 6	1 0 9	
Purchase of books	...	...	
,, cattle	185 4 0	(a) 440 0 0	(a) Purchase of two new pairs of bullocks.
,, implements	293 13 0	15 11 6	
Repairs of tools and plant	55 0 5	50 0 2	
Feed and care of cattle	461 2 5	254 13 3	Purchase of gram for bullocks at cheap prices.
Irrigation	100 15 9	...	
Manure	40 7 0	53 5 0	
Variable labour, agricultural	216 0 7	158 9 0	Economising of labour and utilizing to full the permanent staff.
Do. earthwork, &c. ...	22 0 0	...	
Packing and freight	82 2 1	85 0 3	
Sewage Farm	1,352 0 5	1,162 8 0	Payments to Municipality reduced by Rs.190.
Binding charges	1 8 0	(b) 46 2 0	(b) Binding Farm Reports for 1895-96.
Other miscellaneous charges ...	287 8 6	213 5 3	
Total ...	3,512 13 4	2,579 12 2	
Establishment	3,820 7 3	3,790 9 0	
Total ...	3,820 7 3	3,790 9 0	
Travelling allowance of Superintendent ...	45 6 0	26 0 0	
Total ...	45 6 0	26 0 0	
GRAND TOTAL ...	7,378 10 7	6,396 5 2	

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